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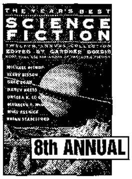
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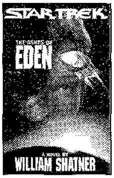
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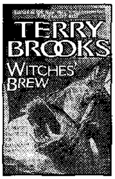
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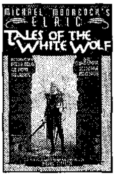
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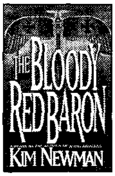
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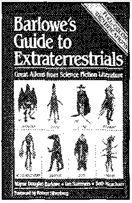
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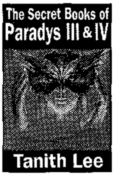
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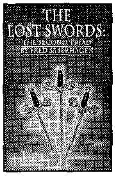
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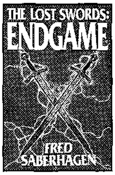
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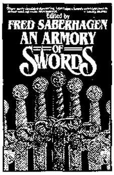
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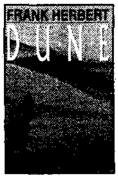
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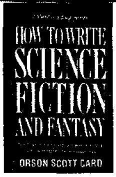
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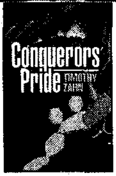
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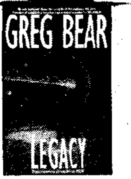
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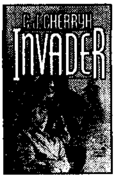
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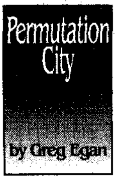
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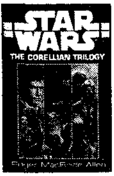
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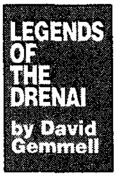
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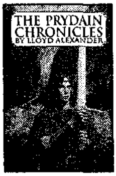
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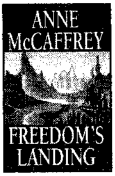
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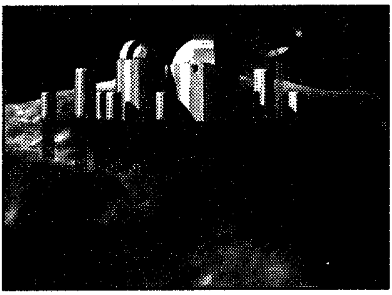
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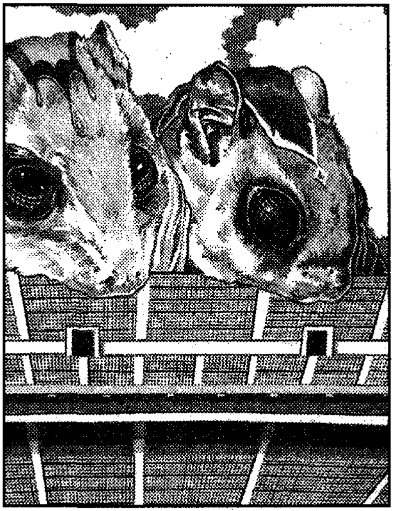
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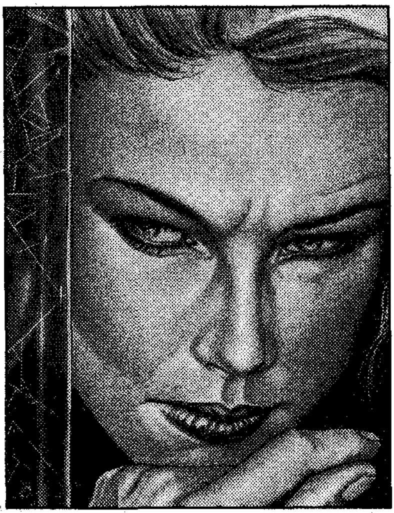
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MIRRORS FOR REALITY

A few months back, my eye was caught by a headline on a newspaper feature story: MORE SMOKING IN THE MOVIES THAN IN THE REAL WORLD. The gist of the article was that a recent statistical study had analyzed 30 years of movies and found that the percentage of their characters who smoked was higher than that of their real-life counterparts in American society. I haven't seen or analyzed the raw data, but the conclusion may well be correct.

So what?

Movies also contain a lot more killing, high adventure, car chases, slapstick comedy, deep tragedy, heroism, and villainy than real life. On the other hand, they contain a lot less standing in bank lines, sitting in cramped airplane seats for hours and hours, PTA meetings, grocery shopping, lounging anesthetized in front of TV sets, and filling out of income tax returns.

My point is not to defend smoking or killing, or even their depiction in film. There are plenty of good reasons to avoid smoking or killing (though the ones for killing are much stronger than those for smoking). I could probably even make a good case for reducing their prevalence in movies—but it wouldn't be based on how closely their statistical abundance matched that in the real world at large.

If you're going to insist that the relative frequency of those acts in movies or stories closely match that in reality, logical consistency would seem to demand that you apply the same criterion to *all* aspects of reality. In other words, you'd try to make movies and stories that resemble real life as closely as possible. Such things would undoubtedly be applauded by certain breeds of critics—but hardly anybody else would want to sit through them. Practically all of us spend large portions of our lives doing necessary but mundane things that aren't very interesting to *us,* much less to anyone else. I certainly wouldn't want to watch a movie or read a book that spent as much time on those things as we all must in reality, and I don't believe you would, either.

Literature (in which I here include movies) isn't, shouldn't be, and can't be just a mirror for reality—past, present, or future. Nobody's seriously interested in watching a piece of entertainment that has all the exact same proportions of everything that happens in reality. No single movie or book *could* do that, anyway; the scope of reality is too much broader than that of a single work of art. But even if it could, it would be a mistake. Despite a fad that occasionally surfaces for "slice of life" writing, the mark of an artist who actually reaches audiences is his or her skill in picking a *subset* of reality that's particularly interesting, engaging, or moving—and then deciding how much emphasis to give each part for best effect.

Poul Anderson once remarked that the best science fiction requires a "unitary" approach in which "philosophy, love, technology, poetry, and the minutiae of daily living would all play parts concomitant with their roles in real life, but heightened by the imagination of the writer." James Blish added, "You will note, I think, that this is more than just a prescription for good science fiction. It is a prescription for good fiction of any kind."

But "concomitant with their roles in real life" *doesn't* mean "in exactly the same arithmetical proportions." A novel depicting an unusual human culture, for instance, might occasionally make passing reference to the fact that all its members visit their version of toilets several times a day—but it will seldom, if ever, be necessary or artistically desirable to describe every visit in graphic detail.

Stan Glantz, one of the researchers in that smoking-in-movies study, was quoted in a Gannett newspaper article about another concern: "The impression kids get from watching these movies is that most people smoke and smoking is something done by desirable figures." Well, maybe. I could hardly deny that people, especially young ones, do sometimes latch onto something in a movie or book as a "cool" thing to emulate. But it's not always obvious which ones they're going to latch onto, and I don't often hear the same concern being expressed about many other activities. So I must wonder, when I hear someone express this kind of concern about the portrayal of a particular activity in movies: is their anxiety primarily about the mind-molding potential of movies generally (which presumably goes far beyond any single activity)? Or is it more about anything that might contribute in any way to a particular habit that they personally oppose?

Which leads me to a concern of *mine:* the current popularity of trying to pressure everything into "political

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correctness.” (Which, by the way, a reader recently complained was simply a generalized smear term with no real meaning. Not so! As I use it, and as I've usually seen it used by others, it means, “Conformity to standards dictated by somebody's political agenda.” People demanding it seldom use the term because their concerns are one or more *specific* political agendas which they see as of overriding importance—but all of them are subspecies of PC.) Demanding that art show things exactly as they are is unrealistic and will tend to produce boring art. Demanding that it show things as some pressure group thinks they *should* be is dangerous. It has the potential to turn all art into fashionable propaganda.

One of the most ridiculous fairly recent examples of this kind of criticism that I can recall was an article about some group lambasting the Disney movie *The Lion King* as “racist,” “sexist,” “homophobic,” etc., ***ad nauseam***—all charges that could only be supported by making wildly unjustified assumptions about the makers' secret motives and far-fetched symbolism. I have some hot news for these critics: lions aren't into political correctness, human-style. They have their own ways, quite different from human ones. In my opinion (as one who had recently spent a lot of time watching *real* lions on the Serengeti), the movie showed them with a surprising degree of accuracy, especially for a cartoon. (Not perfectly, of course; naturally there was some poetic license taken, and some outright

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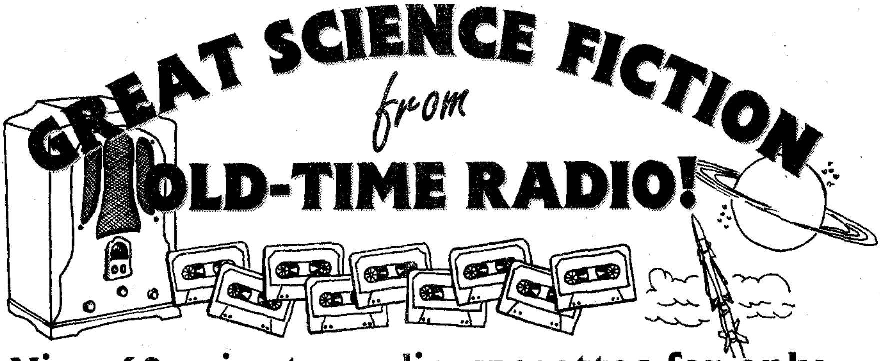
What does all this have to do with science fiction? First, it is *fiction,* and the matters I've been discussing are relevant to *any* kind of fiction. But beyond that are the *special* attributes of science fiction not shared by other types. If it's ridiculous and/or dangerous to demand that fiction about the *present* conform to somebody's idea of What Reality Is or Should Be, how much more ridiculous and/or dangerous is it to make the same demands on fiction about the *future?*

Every few years I like to state more or less explicitly my own vision of what science fiction should be—which corresponds fairly closely to what I try to make *Analog*. Science fiction is fiction that recognizes that the future of science is inseparable from the future of humanity, and tries to imagine both without slighting either. Its *first* mission, like that of any fiction, is to entertain the reader (which is *not* an easy, trivial, or ignoble task). Its second mission, the one that makes it special, is that it tries to imagine possible futures. Not *the* future; it is not a science fiction writer's job to try to predict what *will* happen, but rather to imagine a wide range of possibilities that *could* happen.

This requires that a science fiction writer have a pretty good understanding of where science and technology are now, and the principles that will guide their future development. A real science fiction story virtually always has at its heart some piece of scientific or technological speculation, something so deeply woven into the nature of the characters' problems and their resolution that you can't take it out without making the whole story collapse.

The speculative science will be worked out to make it as plausible as possible in the light of what we already know about scientific principles—but it may also recognize that there may still be new principles waiting to be discovered. Thus you *can* use faster-than-light travel, or even ghosts; but whenever you use something that looks impossible, you must provide a plausible basis for believing it could actually happen. Otherwise it's fantasy—an enjoyable game in its own right, but *not* the same as science fiction.

(Lately, by the way, I've been seeing quite a bit of a particular type of confusion on this point in manuscript submissions. Some writers seem to think that, for example, a story about a wish-granting entity is science fiction just because the wish-granter is a computer rather than a genie or a good fairy. Sorry, there's more to it than that! [See above.] *Occasionally* our readers will appreciate a well-done fantasy with just the right whimsical connection to science or technology, like Stephen A. Kallis, Jr.'s "Murphy," Charles L. Harness's "H-



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Tec," or Harry Turtledove's "Secret Names." But they won't let me get away with it very often!)

Science and technology are not, of course, *all* you need to know to write the kinds of science fiction I'm looking for. Just as technology doesn't evolve independently of human nature and social conditions, human nature and social conditions don't evolve independently of technology—and they *certainly* don't stay the same indefinitely! Hence my dismay when I hear people complain because some piece of science fiction shows a future society that acts significantly different from our own—or from what somebody hopes ours will turn into (or revert to). People's attitudes and standards of behavior have changed significantly, several times, just in my lifetime. They will surely change far more, and oftener, in the future. Actually, about the *least* likely future I can imagine is one in which everybody acts just as they would have in 1950 Mid-America, or according to some 1996 crusader's vision of Utopia.

The idea of literature as a mirror for reality isn't such a bad metaphor, really. You just have to remember that there are many kinds of mirrors. Flat ones show reality just as it is—which provides very little of what Poul Anderson described as "heightened by the imagination of the writer." Correctly placed, they can let you look around corners into places that would normally be hidden. Convex ones let you look at things as from a distance. Concave ones magnify, letting you scrutinize details that might normally be overlooked. Clothing stores have occasionally been caught using subtly distorting mirrors in fitting rooms, which showed customers as they'd *like* to look instead of as they *did* look. Funhouse mirrors distort everything, with results that are occasionally, as the name suggests, more fun than literal accuracy.

All kinds have their uses. Those who use artistic mirrors, whether as writers or readers, should not limit themselves to any one type. ■

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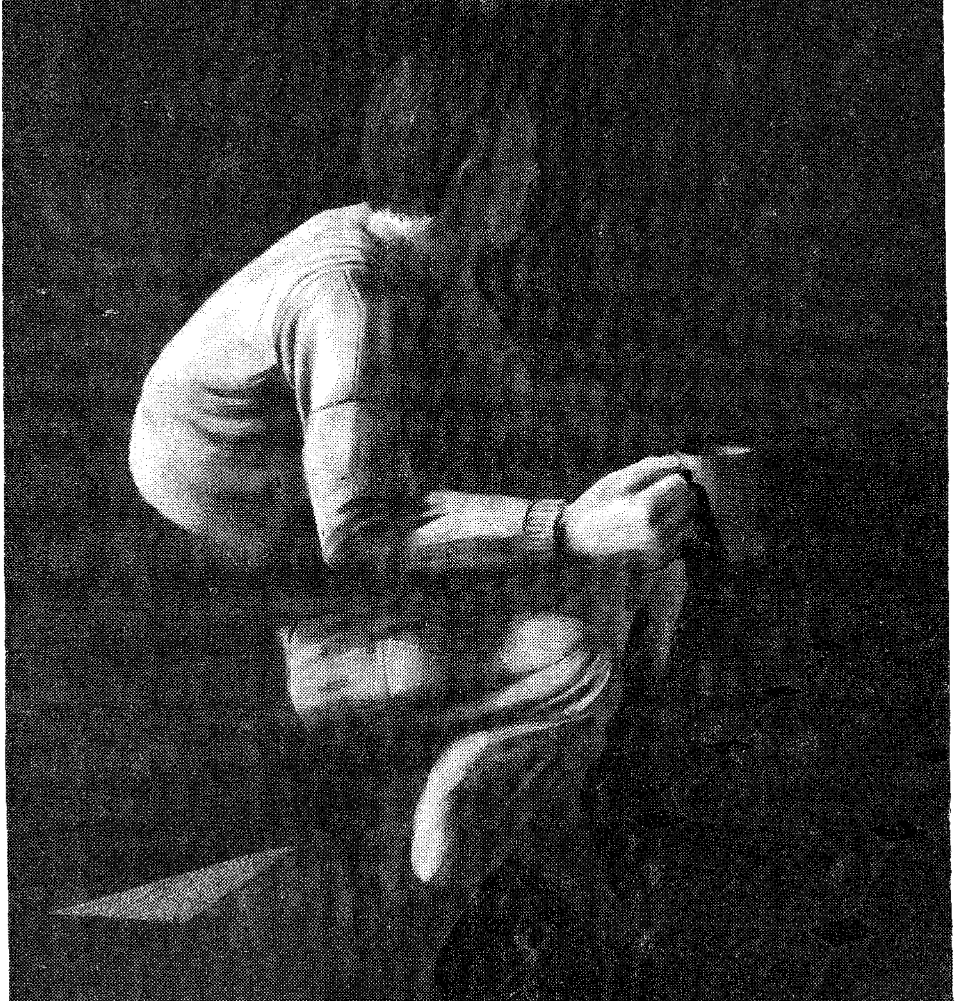
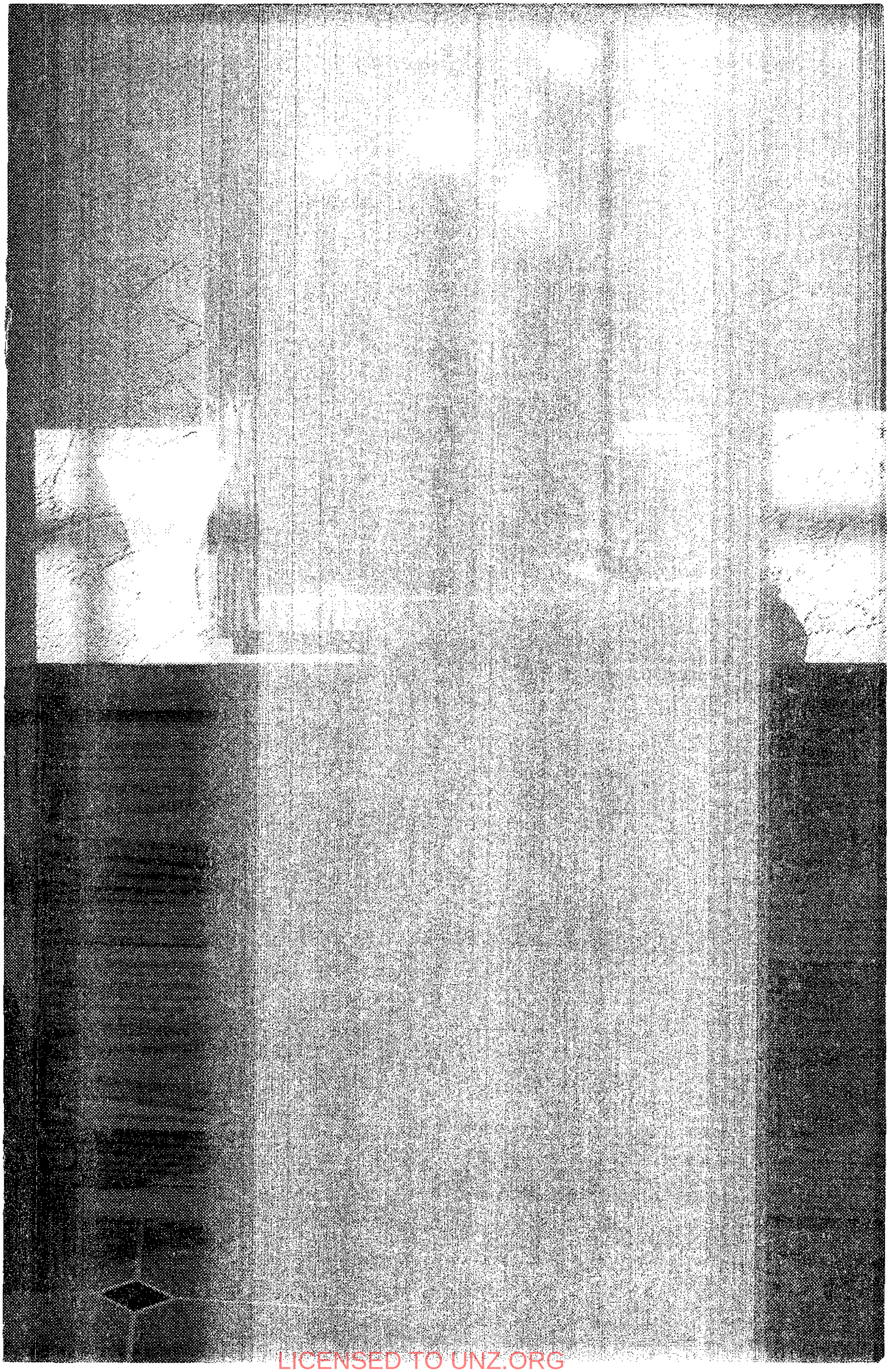
Alexis Glynn Latner

A PILLAR OF STARS BY NIGHT

The very things that make some eager for starflight may make others determined to prevent it.

Illustration by George H. Krauter





Dozing in his sleeping bag, Mark Willson heard a shrill, faint and unwelcome whine. Culex, as well as Saltmarsh and the Asian Tiger mosquitoes, thrived here, so he pulled the bag's mosquito hood around his head. Just before he slid back into sleep, he vaguely realized that the sound was not a mosquito at all. It had an unpleasant metallic edge.

Later, a meadowlark singing woke Mark up for good. With a yawn, he turned his mind to the day ahead of him. He had work to do on his doctoral dissertation in ecology: "Restoration of a Coastal Tallgrass Prairie." This morning he would do a species count in the J-3 plot of his grid of string laid across the grass. Writing up notes and analyzing data could wait for the heat of the afternoon.

His notebook computer trilled at him. The message window said CALL ECOL OFFICE.

Not yet, Mark thought.

URGENT, the computer continued.

But it had said "urgent" two days ago, when the new department secretary wanted to know where he'd filed the *Lepidoptera* reference disk. He would call back later.

Mark walked out onto the porch of the study hut. Not to start work quite yet—he still had to eat breakfast and find his hat, essential under Earth's frayed ozone layer. A pool of coral glowed in the eastern sky, the Sun rising on the little piece of prairie, silhouetting the warehouses in the large industrial district that started where the prairie grass stopped. A mile to the west, the Clear Lake City rail station gleamed in the early sunlight. Mark breathed deeply of air that smelled damp and green, like a healthy greenhouse. He loved spending the night in the study hut, waking up to mornings in this oasis of hope for life on Earth.

Sunflowers flanked the porch, taller than Mark although he had the advantage of standing on the porch floor. *Helianthus giganteus,* huge and hairy stalks festooned with sunburst blooms. They were volunteers: unlike most of the flowering grasses, they hadn't been reintroduced here by ecologists, but showed up on their own. They were a resilient species. Even if the world grew still hotter and ecozones climbed to higher latitudes, with the sea flooding behind, *H. giganteus* would stalk northward along with its preferred climate.

Inconspicuous in a melee of sunflower leaves, a coffee cup belonging to Annetine van Leeuwen rested on the porch rail. The cup was genuine porcelain with a thin gold rim and a quaint Asian butterfly design. Mark smiled. Anna must have forgotten it before she left for Amsterdam to visit her relatives this summer. An entomologist, Anna had reintroduced butterflies, beetles and other insects to this scrap of prairie. Mark found an accumulation of coffee-tinted rainwater in Anna's cup. He crouched to empty the water onto the bright blue dayflowers by the porch steps.

A shrill whine, like the mosquito he had thought he heard before he got up, pierced the air. Mark jerked his head up. That definitely was not a mosquito. It was machinery, and closer than the warehouses, hidden from his view by the tall grasses and sunflowers.

Mark ran along the cross-prairie trail toward the strident sound. Grasses whipped his legs.

A huge, orange, hydraulic monster was scything down the grass on the far edge of the prairie. The machine hit a stump and emitted another whine.

Mark dashed to the machine. He stepped in front of it.

The operator stopped it with a thunk and shouted at Mark in Spanglish. *Man, are you crazy?!*

Mark understood the Spanish-English pidgin. Racking his brain for usable words, Mark explained the situation in Spanglish. *This place belongs to the University, for to study flowers and birds and all! Don't hurt the grass!*

The machine operator explained in turn. *The tide is high in Galveston, and she is red.*

Red tide, the toxic bloom of microorganisms in the sea that had occurred more and more in the Gulf of Mexico as the Earth's climate warmed. And melting polar ice made high tide on Galveston Island very high indeed.

The streets fill with dead fish and things. Stinking germs come in the houses of the people. People will get sick there. So they come here.

Mark recoiled in horror, realizing that the prairie had been designated as a refugee camp for people fleeing from a disease-ridden fish kill on Galveston Island.

Two uniformed men approached Mark over the carnage of mown grasses. Their uniforms were those of security contractors. "What are you doing here?," demanded one.

Mark fumbled for his identity card. "I work here. This is a university study area, and—"

"Not any more, it isn't. Maybe you didn't get the word. This real estate's been appropriated for a refugee camp."

Mark protested. "It already is a kind of refugee camp for the plants and animals here! The University—"

Running Mark's identity license through his pocket computer, the security guard laughed. He flipped Mark's license back at him. "People come first. And you're an unauthorized civilian. Leave it, kid."

"*Why here?*" Mark screamed.

"It's the only piece of empty clean real estate in a hundred miles!" the other, older guard retorted. "You're educated—don't you know anything about politics?"

The machine operator shrugged at Mark, impassive.

Mark could collect his gear if he did so in five minutes. In ten, Mark stood on a buckled asphalt road outside of the fence around the prairie. Yellow tape strung along the fence said RESTRICTED—DO NOT ENTER. Mark clutched a flimsy computer printout, a trespass warning. If he tried to reenter the area he would be arrested. His hand, holding the printout, shook.

Mark turned away, stumbling on the road's cracks and potholes. Weeds grew in the broken edges of the asphalt. Dandelions. Ragweed. Peppergrass. In front of a particularly big and ugly warehouse, the roadside weeds were brown, treated with herbicide, dead, fringing a ditch filled with chalky water. There would be no frogs in the ditch. Frogs breathe with their whole skin, and when their world is poisoned, they die, and the ecosystem falls apart where the frogs should be.

Mark felt unfriendly eyes on him: guards at the front gate of the warehouse, sizing him up as undesirable. Mark avoided their gaze and their gate.

A red tide rose inside of him, echoing the sickness of the sea. It was his blood, and he heard it pounding in his ears. Tears, salty and hot, hurt the skin of his face, already sunburned because he had forgotten to put on his hat.

The Clear Lake railstation was busier and noisier than usual when Mark lugged his gear up the high stairs to the platform. Unloading a train of machinery and supplies in yellow wrappings, workers and a few peremptory officials crowded waiting passengers to the edges of the platform. The morning wind came up. It blew from the south, from the sick sea, and it stank.

The high-speed train took Mark north. The wide, smog-smeared city of Houston, with a beveled crown of an arcology that reared above the smog, flared on the horizon. Houston rapidly swelled and swallowed the train.

Mark got off at the South Main railstation and shuffled toward his home. When he reached the security gate of the graduate student apartment building and thumbed himself in, Mark realized that the red tide inside had receded. He didn't feel angry any more. Instead, he felt like a beach littered with dead hopes and dreams.

His roommate was seated in an armchair in the living room, contemplating the antique picture on the wall. He waved a hand at the sound of Mark's entrance without looking Mark's way. Ev—who was, as of a few months ago when he had successfully defended his own doctoral dissertation in molecular biology, Dr. Evrett Reynolds—seemed preoccupied.

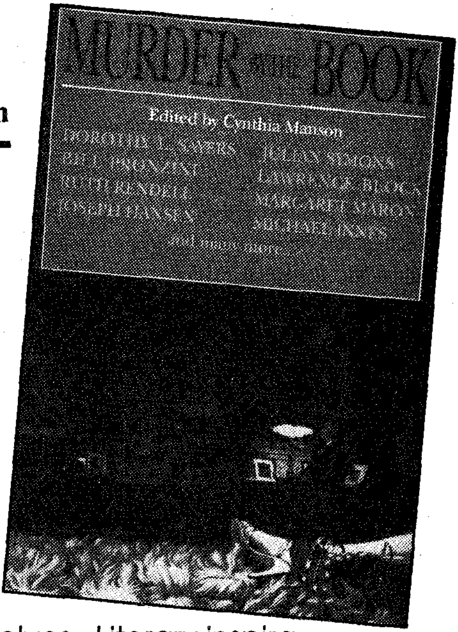
Wretched and dirty, Mark intended to creep wordlessly to his bedroom. But Ev snapped out of his reverie and looked around. "Wait a minute—what are you doing back? And your face is burned! What happened?"

Mark mumbled an explanation.

"Oh, no!" Ev leaped out of the armchair. "It's probably been in the Netnews, which I have not been watching. I would have called and warned you! Damn it, your department should have!"

"Never mind." Mark veered toward the kitchen to make the coffee that he never had this morning. His head ached. He fumbled with Ev's coffeemaker. Following Mark into the kitchen, Ev hovered behind him offering sunburn ointment.

Clumsy and distracted, Mark knocked the coffeemaker over. Wet grounds spilled out of the gold filter cone onto the counter. Mark stared at the mess. It was hard to breathe and harder to speak. "Remember Samantha Berry's last lecture? The new world?"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Ev leaned against the counter. "Um, yes. Ecology 401. Midway through the semester. 'A new world,' " Ev quoted Samantha Berry. " 'Not just a bubble on a moon. And not an inferno like Venus or a frigid, desiccated desert like Mars. A green new world, if human colonists are smart and diligent enough to terraform it properly.' "

That lecture had been Professor Berry's way of announcing her resignation. Six weeks later the starship had left, with ten thousand colonists in cryostasis, to be revived hundreds of years in the future at an Earth-like world near a sunlike star. Berry was one of the colonists. Her colleague Annetine van Leeuwen took over teaching the Eco 401 course.

"There's going to be another terraforming starship," Mark said. "It's being built now."

"I know," said Ev. "A family friend is the principal contractor, operating out of Luna Prime."

"This one's sponsored by the Genesis Foundation. They've asked me to go or at least serve as a consultant in the planning process. What they want to do they're calling creation ecology, and it's a lot like restoration ecology. I've made up my mind to do what I can to help them. And maybe when the ship leaves, I'll go with it."

Ev stared at him. "I don't believe I just heard you say that. It's the stress of the morning, isn't it?"

At that moment, a roach crawled out of a cranny in the kitchen counter and ventured toward the spilled coffee grounds, feelers twitching. Mark's stomach turned at the roach.

The land here had been coastal tallgrass prairie, with a delicate web of naturally evolved species. But prairie was supplanted by the city and the opportunistic species which exploded in that kind of ecological vacuum anywhere in the world. Pigeons, crabgrass, rats, gnats. And roaches. The city teemed with roaches, ubiquitous in the better neighborhoods even in spite of pest control and fastidious housekeeping. In the poorest areas they were a crawling, chitinous plague. The delicate web of species had been blasted. And he, Mark Willson, could not restore it. He slammed a fist down on the counter. The roach scuttled back into its crack. "I can't stay here and watch the Earth die!" he yelled.

Ev said slowly, "I was thinking about the stars just before you came in." He gestured toward the framed picture hanging on the living room wall.

The antique print depicted the star cluster called Pleiades shining across the night sky of a distant world. The print was pretty and precious.

Ev would never go to see any distant stars with his own eyes. Ev had everything he wanted here on Earth. And if that wasn't enough, Ev was a citizen of the Solar System, cosmopolitan and comfortable with the offworld lifestyle in habitats and colonies.

Ev said, "I always thought you were the last man on Earth who'd talk about leaving for the stars."

"I'm not," Mark said. "You are."

Ev smiled. The smile traced the lines of his grin, without any humor in his eyes, which made his expression seem like a rictus. "I know. Don't I have a lucrative job with the number-one genetic engineering corporation in the world? And I'm good at what I do. I can get blood out of a turnip. Blood and money. Out of turnips and mice and butterflies."

Mark recoiled. He ground out the words, "You'll get used to your job."

"Should I? You help green things grow. But what I do—should I get used to it?"

Mark could not handle Ev's problems and, if that was what this was, Ev's guilt. Not now. Mark turned away.

"I am the taskmaster, living chromosomes are my slaves! Should I get used to that?" Ev insisted, following Mark back into the living room.

"What else?" Mark grated.

"It wasn't just has-beens like Berry. Thousands of the best and brightest people went on that starship, too. Such as Joseph Norden. As in Norden dogs, Norden sprites, Norden twists. He was the best theoretical molecular biologist of this century. But he went to the stars."

The Pleiades print, Mark belatedly noticed, had been shifted to a new spot higher on the wall, and Ev's side-table moved beneath it, with a model of a spaceship and crystal vase on the table and fresh flowers in the vase. The arrangement looked incongruously like a shrine. "I think I need to go to the stars, too," said Ev.

No, Mark thought. Ev would never do that. Not bright-eyed, mercurial Ev. "You don't mean it."

"Well, do *you?*"

"I said I'm thinking about going. And I am," Mark said. His own voice sounded bleak.

In the middle of the following night, Mark had a nightmare. He woke up in a sweat with his heart fluttering, his limbs semi-paralyzed, his sunburned face hot and hurting.

His small bedroom was full of plants. In the faint night-city light from the window, the plants had dim gray and dreadful shapes. Mark groped for the switch to throw lamplight onto the plants and make them return to green normalcy.

It was the Pleiades. Ev's picture had gotten to him.

Ev had found the print at an exclusive gallery Uptown a couple of years earlier, fallen in love with it, and purchased it on the spot with his father's credit and his own good-sporting grin, while Mark boggled at the price. Mark had thought that he had gotten used to it, respecting the fact that it was classic space art though not to his own taste. It had a nice name. *Ladies of the Lake.* But the picture had finally unnerved him.

He had dreamed about that world with no living green, only ice mountains ringing a blue sea of nitrogen, bitterly cold to all eternity, beneath a night sky radiant with blue starshine. The cold burned. The stars' irradiance would destroy the delicate molecules of any Earth-like life. *Ladies of the Lake* told him what the stars were like, the reality of space outside of the fold of the Earth.

Too tired to be fully awake, too disturbed to be fully asleep, Mark twisted in his bed, hagridden by seven sapphire stars.

Ev admired both views. This was a good table by an extraordinary window, beyond which the bright, benighted city of Houston stretched into the distance. The air swarmed with the firefly lights of the aircraft that, in this century, had replaced ground-going automobiles for the travel needs of people wealthy enough to own their private transportation.

The other and more immediate view which presented itself to him was that of Dr. Miraly Fiorenza, seated across the table. She had a thoughtful expression on an intelligent face, and a sapphire-blue blouse cut attractively low.

Miraly seemed interested in his account of disaster on the prairie and the decisions that ensued from it. "That was a year ago? Why aren't you selling your possessions and living like a monk?"

Bingo, Ev thought. She really was interested. And not just in the story. He felt a pleasant flush of erotic feeling, and answered, "The ship won't leave for another two years."

"*Carpe diem?*"

A dark-clad waiter materialized. This, the Houston Club, was the apex of the arcology that crowned the city. The club was the jewel in the crown and the haunt of the rich and powerful, and fraught with unwritten rules. One rule was that everyone in the party must order a drink. Another and slightly more cryptic rule was that the drink must be something classic. In mid-twenty-first-century America, wealth and power donned the trappings of earlier ages. Ev ordered two Old Fashioneds, and thus obeyed that rule with conscious irony. With a satisfied twitch of expression, the waiter glided away.

"There are more important things to do than curl up and wait for the trip," Ev told Miraly.

"Such as?"

"Mark is supplying seeds to the Genesis Foundation for the terraforming project. And I'm working hard, and learning all I can, at Pennington Genetech. We may need new organisms in the new world. Organisms that somebody like me can tailor from normal species."

The waiter returned with the drinks. Ev sipped his. It was perfect, a fine balance of the bitter and sweet and citrus on the base of alcohol. He waved his glass in a circle meant to include the ambiance, the view, and Miraly. "In the meantime—*carpe diem*."

Her lips on her glass curled in amusement. "I absolutely cannot imagine you on a frontier world."

"Oh?"

She made a circular wave to imitate his. "I know a fish in its water when I see one."

"I grew up on Titan. Dad's an executive with the Lunar Mining Company, trans-Martian division." Ev was gratified to see her react with surprise. "Frontier worlds are nothing new for me."

"Well, well. You don't seem nearly hardscrabble enough to be an outplaneter."

"The company pays Dad handsomely. While I was growing up, we vacationed on Mars, Luna, and Earth,

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by Rocky Holman

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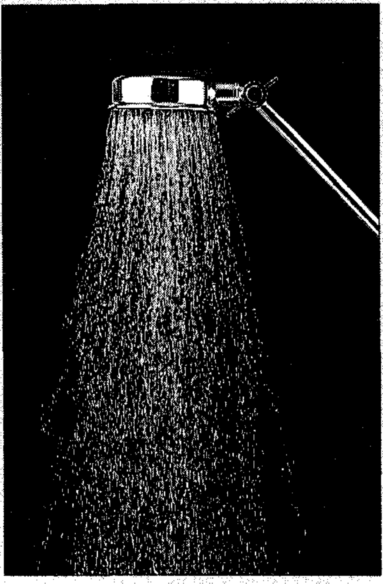

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first class all the way. I also spent five years at an exclusive boarding school in Europe."

"Thus the polish," she mused. "But you, digging in the dirt to make tomatoes grow on a colony world? I still don't buy it."

"When the ship finds a new world, the plan is to have it as an orbiting city while the world is terraformed," Ev pointed out. "The first generations downside will live in domes. Only people like Mark will be digging in the dirt."

"He sounds sweet."

From her tone, Ev realized that he must have described Mark in terms that appealed to Miraly. Did that mean she would prefer a man like Mark to one like Ev? No, not necessarily: maybe she liked lost kittens and sad-eyed puppies. And maybe she would accept an invitation to go home with Ev just a bit more readily if it involved the occasion to meet and sympathize with sweet Mark. Ev filed the thought in the back of his mind. "He's not cut out for modern life. Doesn't quite realize that Earth is like one of those plants of his. Goes to seed and dies."

"Is it that easy to for you think of Earth dying?"

There was a barb in her words. The black-haired rose had a few thorns, Ev thought, intrigued. "Have you observed Earth from space?" he countered. "What with the smog and desertification visible from orbit during the day, and huge splotches of urban light on the night side, it's obvious that Earth is going to seed."

"But it's not natural for Earth to die, like it would be for one of Mark's plants. It's things like pollution, war, overpopulation, politics."

Ev sighed. "I won't argue that. Pennington reeks with the kind of politics that promote the unfettered exploitation of resources, environment or sustainability be damned. Genetic resources are the big issue—and cash cow—at Pennington, but the top dogs support the politics that keep the outplanet colonies dependent and feeding Earth minerals and helium-three for industry. I have not breathed a word about my future plans around Pennington. If the corporate climate is one that doesn't favor independent Solar System colonies, it abhors the idea of a starship that leaves and sends nothing back."

There was a Netnode on table, discreetly metal-toned so as to blend in with the general decor. Miraly activated it. The miniature computer terminal had a small, jewel-like screen and audio muted so as not to disturb other guests here. Ev could barely hear the locator beeps and buzzes as Miraly pulled up a map of the world.

More eager to watch her than the little screen, Ev admired the graceful lines of her body draped by the blue blouse. Tapping the screen with a fingernail, she linked to a region in Brazil, then a medical update indicated by a caduceus icon. A window in the screen showed a ball-and-stick sketch which Ev recognized as a virus of some kind. "This is a disease of cattle," she said crisply. "Somehow a section of its DNA crossed into a human respiratory virus. The result is called KAV, and it's infected hundreds of people in Amazonia."

For the first time during the whole date, Ev remembered that she was a doctor and professor at the medical school in Galveston; her specialty was virology. He had met her at a genetics conference the week before.

She went on. "Pennington Genetech has invented an antivirus, and patented it. And is waiting for the World Health Organization to come up with hundreds of millions of dollars for it. Until then, Pennington won't release the antiviral gene sequence to the public health authorities. The death toll stands at—" She fished for the figure, and displayed it. "One hundred fifty-two as of today. It will rise rapidly. But Pennington's chief executives seem to share the belief that seems all too common today—that the answer to overpopulation is disease. As if the suffering doesn't matter."

"I know." Ev studied the screen and her intent face, harder-edged than it had been just minutes before. He said slowly, "Is this why you accepted a date with me?"

"Did you know there's a joke in the medical community about researchers who work with Pennington? They are a specially genetically engineered strain of human being without the heart. I wanted to find out if you were a typical Pennington clone. And you aren't."

"Glad to hear that," Ev murmured.

"Who do you know at Pennington?"

"Not top people who could spring the virus sequence," Ev answered, suddenly impatient. "Does this mean you won't see me again?"

Her wide, elegant lips turned in an ironic smile that surprised him. "No, as a matter of fact, I think I'd like to see more of you."

Maybe the Old Fashioned was going to Ev's head. But he knew eros to be as psychoactive for him as alcohol. Ideas were mixing in his brain, crossing over from one domain to another, dangerously recombinant. "I have an idea. The Genesis Foundation hinted at channels for under-the-table contributions to the gene library. The Foundation thinks the same kind of politics that Pennington exemplifies are going to weigh against free access to biological specimens for the starship. Therefore I'm playing with ways to make contributions from Pennington's gene banks to the starship's library—without Pennington's knowledge. I think I could smuggle the virus sequence out. Probably within a week."

Surprise and dismay flashed across Miraly's features. She hastily put down the glass. "That would be faster than official deals ever could be—but it's—I'm not asking for that. Are you sure you don't know somebody who can make it happen above board?"

"Absolutely. I don't," Ev said soberly.

"But you could get into serious trouble."

"If I do it for the ship, which I probably will, I'll run the same risk."

"It's a game to you, isn't it?" she said quietly. "Plotting to go to the stars, and if there's a bit of opposition to outwit, so much the better. What will you do when it's time to cash the chips and either leave forever or stay?"

"I'm planning to go."

"I bet you stay. That you don't get

caught if you do smuggle genes out of Pennington, but you stay anyway."

"Maybe." Ev kept his tone noncommittal.

Women didn't usually affect him the way this one did. But then, in his experience, matrons doted on him, while younger ones fawned or flirted. Miraly did neither. Ev felt the way he had when he first saw *Ladies of the Lake* and met brilliant, hard-edged beauty that he could not live without.

He had two years to persuade her to come along to the stars.

In the three years since the disaster of the prairie. Mark's life had been, to all outward appearances, normal. He was now a junior faculty member with papers to publish and classes to teach. In secret, he harbored a purpose and a dread that gave him broken sleep and bad dreams. The single worst and most compelling nightmare happened one evening as he napped after dinner. In the dream, Mark beheld a cosmic wake, the Earth in a tattered, dull green death shroud, and passing comets with the wings and the faces of archangels, mourning. Later that same night, he went through the motions of teaching a seminar in a stunned daze.

With his perpetual ache of insomniac fatigue, the afternoon class in introductory ecology was the most difficult part of the day for him. But he prepared methodically, presented thoughtfully, and struggled to get the importance of the subject across to often disinterested young minds.

Early in the semester, Mark had issued each student in Intro Eco a glass ball and the task of filling the ball with water and a balanced population of algae, brine shrimp, and micro-organisms. The balls were then sealed. By now, mid-semester, a variety of initial mistakes in the composition of the microecologies were apparent, in the form of sick and cloudy or dead and slimy contents in the glass ecospheres.

"The Earth is an ecosphere too." Mark meant to make one more, conclusive point before the hour was over. "That is, a system closed except for energy, receiving from the Sun a fairly constant amount of electromagnetic radiation. Energy from the outside was necessary but not sufficient for life on Earth; life also had to organize itself into a dynamic yet stable balance."

"It's not materially closed any more," objected a student named Pol—one of the Mark's least favorite students. "We've got space resources now."

"True. But Earth always had space resources in the form of meteorite and comet impacts, and cosmic rays and dust." To decisively regain the upper hand, he threw out a testable packet of information. "Life on Earth may have originated with organic compounds formed in interstellar dust clouds. In the early days of the Solar System, there was a continual rain of interstellar dust, some of which contained hydrocarbons, including molecules that may be considered the precursors of amino acids. Thus the dust from interstellar space seeded Earth with the potential for life, if the Cosmic Genesis hypothesis

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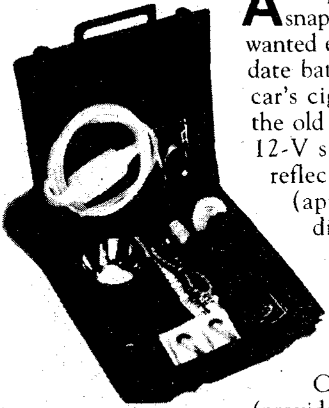

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is correct."

Pol slouched.

"With or without closure of the planetary ecosystem, it's vital that populations of organisms be in balance, constituting a dynamic, yet stable, system. If an ecosystem is destabilized, you get a runaway degradation of the environment—as in some of your ecospheres. In other words, a partial or total die-off."

Pol interrupted Mark again. "But space resources mean we can live under domes on Earth even if nature dies."

"Don't count on it," said Ev, who, to Mark's complete surprise, had appeared in the classroom doorway, startlingly out of place in an expensive business suit. "The out-planets could decide to keep their resources instead of throwing them down into a gravity well."

Mark introduced Ev to the class. "This is Dr. Evrett Reynolds. A research scientist with Pennington Genetech, who grew up on Titan." Mark wondered with alarm why Ev was here. It had to be ship business.

Without asking permission, Ev picked up Pol's ecosphere and walked away to the window's light, examining it. Then he said, "You botched this one. And no fair opening it to fix it up. So you might as well throw it away." Ev tossed the ecosphere back to Pol, who bristled as he caught it.

Mark hastily dismissed the class. Pol left muttering. Some of the departing female students giggled and whispered among themselves with backward glances. Resplendent in the business suit, Ev radiated a sardonic intensity which blew the last of the students out of the classroom, including those who might have lingered to ask questions.

With the room cleared, Ev turned to Mark. "Today the Supreme Court upheld the Alaska law. No exports of wild biomatter. Interpretation extended to seeds and other germ plasm."

Mark felt a surge of consternation, with a sharp and unsettling undertone of relief. He collected his thoughts out of the mishmash of feelings. "It's ridiculous! The law in Alaska was meant to prevent wild places from being dug up wholesale. Seeds, and germ plasm, which the starship needs, are different! What are a few seeds?"

"They're seeds of an idea, and the idea is a new world," Ev said forcefully. "Listen. The Genesis Foundation expected this. The ship leaves *tonight*."

"What!" Mark sagged against a counter.

"Everybody won't make it before the launch, so there'll be a whole fleet of rocket planes and old Delta Clippers coming up from Earth to meet the ship tonight and in the next few days. It'll be a mad scramble. The ship will add passengers from the colonies and outworlds all the way to the end of the Solar System. But they've asked some of us on Earth—such as biological scientists—to come tonight to maximize the chances of us making it out unhindered."

"Unhindered?" Mark stammered. "What does that mean?"

"Mark, the court's decision is going

to be a signal flag. It will encourage protestors, corporations, and the government itself to undertake God only knows what actions against people trying to join the ship and against the ship itself. It's a good bet that the President of the U.S. will declare martial law at midnight tonight."

Mark's nerves jangled. "Wait. Wait! The ship can't possibly have absolutely everything it needs yet for terraforming—"

"The more genes the better," Ev agreed. "We ought to grab extra seeds on the way out."

Automatically, Mark led the way toward the reference collection. Mark thought about the little dead ecospheres. Wrong initial conditions. In some cases, only slightly wrong. End result, the slime of decay. He felt hot and prickly. "They're sure they've got everything to make ecosystems?"

"The planetary ecologists have been running computer models continuously with the species actually in the ship's freezers. The more diversity and redundancy the better. So, now that the chips are down, the Foundation is grabbing everything it can, be it animal, vegetable, or virus."

"The Foundation is *stealing* biota?"

"All over the world."

Astounded, Mark asked no more questions.

"We have to go by Anna's office, don't we?" Ev asked. The ecology department occupied one floor of the ancient biology building. The reference collection was located just down the dusty and crowded corridor from the office of Annetine van Leeuwen. "Does she know you've been planning to go?"

"She guesses," Mark said tersely. He did not elaborate on Anna's sharp glances, the frosty nod of her head when he asked for specimens for fictive research needs, intending to send them to the Foundation for the ship. For years, Anna van Leeuwen had been outspoken in her criticism of Samantha Berry's decision to leave on the earlier starship. Anna had complained bitterly about having inherited the department chairmanship from Berry. Before the starship, the two middle-aged women had been friends and department allies.

Ev said, "She may have heard about today's court decision. It's headlining the news. If she sees the two of us she'll either talk our ears off or call the campus police."

But Anna wasn't in. The door of her office hung ajar, giving Mark a glimpse of the usual clutter within, and her desk, for once, unaccountably, clean.

Knowing that Anna might be no farther away than the women's restroom, Mark and Ev hurried by. A few minutes later, Mark reached into the freezer for small vials marked with his own neat handwriting.

In her valedictory lecture, Professor Berry had described starship stasis, the cold storage for plant seeds, germ cells, bacterial spores, and people. In a few months Mark would be in the freezer, and in a few hundred years, on the other side of the stars, being pulled out, insensate but alive—if he was lucky. His hand shook.

"Don't make it too obvious," Ev advised.

Mark selected Little Bluestem seeds—a keystone species in its native grasslands—then five more vials at random. On impulse, Mark also seized a vial that contained the fat seeds of *Helianthus giganteus*, the stalking wild sunflowers. He rearranged the vials to obliterate incriminating gaps. Ev leaned casually against the doorjamb to watch the hallway. "Not a sight or sound of her yet. Let's get out of here."

When they were well away from the reference collection, Ev said, "I have to run next door and pick up something of mine that they've been keeping for me. And drop off a letter to Burch, my old advisor. Explaining everything. It's OK—he's out of the country and he won't get back to open the letter until next month."

Mark should have left a note for Anna. He owed her that much, at least. Too late now. They exited the biology building into the breezeway outside.

The day was gray and muggy, typical of this climate zone of greenhouse Earth. Some of the ancient bricks in the walls of the biology breezeway were molded with intaglio designs, biological ones—stylized scorpion, jellyfish, moth, protozoan, annelid. The intaglios had crumbled at the edges from decades of exposure to the acid air.

The breezeway led to the biosciences building, where some of the bricks were intaglioed with a double helix. "I'll be back in a minute." Ev bounded through the main doors.

The Rice University campus was old, brick buildings dating from the mid to late twentieth century. Huge and slowly dying oaks lined the sidewalks. There seemed to be an unreal calm here today, like the Jurassic fern swamps on the eve of the great Cretaceous extinction. Mark wondered what obscure plants and animals would inherit the Earth this time.

Ev emerged from biosciences holding a small animal carrier labeled LIVE MICE HANDLE WITH CARE.

"Patented mice?" Mark asked. "You think the new world will need them?"

"You never know," Ev said vaguely.

It was Ev's ego showing, Mark thought. He couldn't take his prized possessions to the stars, but he'd bring something he invented. They crossed the campus together in silence.

Waiting for the train at the South Main Rail Station, Mark started to say "Bluestem—" but he stopped himself. People milled around the station, university types whom he vaguely recognized, and others whom he did not know. The Genesis Foundation definitely would not want its plans overheard, today of all days. Mark took his notebook computer out of his pocket. He urgently pecked out the words *One grass won't save the new world.* After showing the statement on the little screen to Ev, he erased it.

Ev shrugged.

What if the models are wrong?

Ev took the computer to enter the words, *we'll make it work. i'll make it work. are you coming or not?*

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to terraform a whole, strange, undiscovered world—on the basis of hurried models based on familiarity with no living world besides Earth—this went past hubris into the realm of collective, suicidal insanity. On the train, Mark slumped in his seat.

Ev had the notepad. He handed it back to Mark. *you still haven't decided, have you,* it accused.

The monorail took them toward the center of the city, first through the highrise residential district with frequent stops, among them the one that Ev would have taken to go to the place he shared with his girlfriend. Thoughts churning, Mark asked, "What about Miraly?"

Ev grimaced. "She understands everything all too well. But she still won't come."

Mark was startled. Ev had been so sure that Miraly would go with him to the stars in the end.

"I left everything with her. Including *Ladies of the Lake*." Ev settled back in his seat, profoundly pensive.

Mark could not understand how Ev could leave Miraly. Mark loved the Earth. And he did not know whether, loving Earth as he did, he could bear to desert it.

Over the city loomed the shape of the Uptown arcology, a pyramid supported by three pillars—each pillar a skyscraper in its own right, but dwarfed by the pyramid. Mark blinked. Today everything seemed unfamiliar, in the dreadful light of leaving forever, unreal. Uptown reminded him of an ancient motion picture about an invasion of huge long-legged machines from Mars.

Entering the Wards, with no stops for the poor and crowded people who lived there, the train accelerated. Hurtling along its elevated rack, the train arrowed under the skirt of the pyramid, decelerating. When it halted, they exited onto a platform.

Another train would soon come to take them to the airport. Ev had bought tickets for both of them on a commercial flight to Star Field.

The platform stood high enough above the ground to activate Mark's uneasy fascination with heights. He peered over the guardrail into the dirty and dismal neighborhood below the rail track. Neighborhoods like this stretched for miles in the innermost part of the city, the enormous area called the Wards, crammed with the underclass which was truly, physically under—relegated to the ground beneath the shining bulk of Uptown, in its shadow.

Garish words, both Spanglish and the semi-literate English called Manglish, were scrawled on every wall and sidewalk in sight. A rotten smell drifted up from the Wards, lofted by the heat of the day. It was not the reek of a living compost heap; it was truly foul.

"I see somebody I know," Ev said. He nudged Mark's shoulder, indicating a middle-aged man, face obscured by large dark Virtuality glasses, who disembarked from the train farther down the platform. "Pennington company man and very loyal. I do believe he was lurking around the South Main rail station, and now he's getting out here. He may be following me. So let's visit Uptown."

Mark was appalled—less so than if Ev had suggested an excursion into the Wards, but not much less. "No!" he hissed. "I do not want to spend any of my last minutes on Earth in Uptown!"

"Pennington doesn't like the police becoming involved in its affairs. The company might take rather forceful action on its own, without stopping to consult the police, if it should realize what I've done." Ev pointedly did not indicate the mouse carrier under his arm, draped with his concealing suit jacket. "I don't want my colleague over there to know where I'm going or guess why. We can lose him in Uptown. Come on."

Mark followed with great reluctance. Even when he had occasion to go there briefly and in the best of moods, Uptown always made him feel like a gasping fish out of water.

Ev was an amphibian. And he led them to the Uptown escalator at a brisk stroll. Ev leaned against the escalator's handrail as he turned to talk to Mark, on the next lower step. "This is a world-class Highcity, you know."

"As a matter of fact, I wouldn't know," Mark replied, glum. "I don't patronize them like you do."

Ev swept the escalator and the sidewalks below with his gaze. He said cheerily, "It's in the same league as LA High, the Tower of London and Luna Prime. With a better unifying environmental motif." Mark snorted in disgust. Ev turned to take a well-timed step off the escalator into the shopping district.

As he followed suit, Mark looked over his shoulder. He thought he saw the Pennington man, the thick black Virtuality glasses bobbing among the other heads of people being conveyed up by the escalator. But Ev led Mark away quickly. Mark lost sight of the glasses in the crowds that filled the lowest, mall level of Uptown.

Throngs of people, the City's professionals leaving work and its affluent and leisured class coming for entertainment, surged through the pyramid's thoroughfares in waves, much like corpuscles pumped through broad arteries and narrow capillaries. Except that Uptown had no heart.

The upper levels of Uptown were full of offices. An artificial stream descended from the pyramid's apex to its base in spectacular indoor waterfalls. Between descents, the cascade flowed through pools and fountains on each level. Lush, well-groomed vegetation fringed the stream. "They did a particularly nice job with that fall," Ev remarked, wandering toward the pool at the foot of the waterfall that tumbled down to mall level.

Mark glowered back. He loathed the stream. It pretended to be the soul of a forest. Clear and lifeless, a zombie imitation of something natural; it was an only an elaborate exercise in plumbing.

Ev stepped onto the stone path that led behind the falling water. Directly behind the waterfall, its sound absorbed his words. Only Mark heard him. "Mark, *have* you decided? It's not a game anymore, not even for me. If we get stopped before the ship leaves, it could be unpleasant for us. You can back out now without having lost much more than a good many nights' sleep."

The liquid curtain blurred the crowds and the stores and bright lights of Uptown into a patternless watercolor. But the sharp edges of Uptown's artificial color in fresh sharp memory pained Mark, as did the foul reek of the Wards, Uptown's malignant shadow. And the whining sound of a bulldozer hitting a stump still rang in his ears even now, years later. "I want to go to Star Field."

"For sightseeing, or for a further trip?" Ev asked drily.

"I'm still thinking."

Ev sighed. "Follow me." He plunged back into the shopping district.

Minutes later, to Mark's surprise, they stepped out into daylight high on the pyramid's side, at the skyport. Ev said, "Interested parties could find out about the airline reservations I made for us, but not that I parked my dad's jet here. I used an alias."

A valet wheeled the Merlin out, its silver skin and blue stripes gleaming, freshly washed. Under its forward-swept wings, the two big ducted fans were locked into position for a vertical takeoff. Ev preflighted the Merlin. He cycled its control surfaces and checked the fuel. Mark steeled himself and climbed in, buckling himself into the copilot/passenger's seat.

Ev peered into the cockpit at Mark. "Usually you say something about how *little* it looks, and you pace around looking unhappy until time to take off. I guess you mean what you say about going as far as Star Field."

Grim and impatient, Mark watched Ev, now in the pilot's seat, finish the preflight checklist, using a string of icons on the glass instrument panel. The jet engines spooled up with a rising whine. "Here we go," said Ev, commanding takeoff thrust. The ducted fans lifted the Merlin almost straight up from the pyramid into the gray air. The ascent tweaked Mark's stomach. High over the city, the Merlin's fans rotated into position for horizontal flight. The Merlin surged forward and merged into the interstate air traffic stream.

The little jet tilted toward its final course, westward. Mark stared out at the horizon that was bloodied by the tag end of sunset. The live animal carrier rested on Mark's lap. One of the mice inside squeaked.

"Hey, thanks for holding that," said Ev. "The trip would jolt them more if the carrier was just strapped in the baggage rack, and they're gentle and insecure by nature. Nice mice."

Mark glanced at Ev. Tonight—maybe because of the red sky's light tinting his blond hair weirdly pink—Ev looked strange to Mark. Mark remembered the Reynolds family nickname for their son. According to Ev, from an early age his parents had called him Bem, short for Bright-Eyed Monster.

Ev informed him, "That's San Antonio off to the right, and the Edwards Plateau, where the land stops being coastal plains and develops interesting wrinkles—see? I can get us an even better view if I drop a wing." Ev's hand rested on the slender sidearm control stick. He twisted his wrist.

The earth below lazily tilted. Mark

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closed his eyes. "Ev, you know how sometimes I don't tolerate heights too well? Today's one of those times."

"Oh. Sorry!" Leveling the jet, Ev asked, "I don't suppose you've thought about how we're getting up to space?"

"As little as possible," Mark replied grimly.

Ev flew in silence for a few minutes. Then, "Since this is the last flight—I'm going off the Air Net to do my own flying. OK with you?"

Mark nodded.

"I may even take the scenic route, since we have time to spare. Thanks to Dad," Ev added, giving credit where credit was due and where the line of credit was extensive: the jet belonged to Ev's father. "Some private jets can't get off the Net at all. Dad calls 'em overgrown model airplanes. If you're feeling vertigo, keep your eyes on the horizon. Hey, look at the sunset, that's quite a sight! Have you ever seen a sea of red like that? The orange-brown streak at the bottom of the sky, though, that looks a lot like Titan. And for the same reason. Hydrocarbon smog."

From Titan, Earth was just a blue star beside a brighter white one, the Sun. That must have made it easier for a Titanian like Ev to think about leaving forever. Ev did not seem unhappy, just excited.

Mark hoped that Ev would fly in a straight line with minimal sightseeing. Instead, the Merlin banked again. Mark felt his stomach quiver. "Why'd you do that?" he asked crossly.

"I didn't," said Ev.

The Merlin had an elegant, simple-looking instrument panel with dark, blank spaces for everything not in use. Ev tapped the panel with one finger. More of the dark places lit up: gray-green screens contrasted with the spidery graphics traced across them. Small bright icons flashed. The Merlin had more numerous and informative instruments than did a typical personal jet. Scanning the instrument readings, Ev said, "Aha!"

"What?"

"We're back on the Air Net and San Antonio control is attempting to fly us in their direction. They can do that if a pilot is drunk or disabled." Ev quickly pushed buttons on a keypad set in the instrument panel. "To regain control from their override requires a complicated response sequence, demonstrating that I am not incapacitated." The Merlin's slow curving turn stopped, the jet's nose swerving back toward the sunset. Ev looked over at Mark, and his face was somber. "I wonder who persuaded San Antonio control to do that."

The instrument panel flashed an eye-catching, bright red icon. Ev interpreted. "Traffic at four o'clock. No response to my computer's request that they identify themselves. Move your head so I can see past you." He studied the night sky beyond the back end of the cockpit's bubble canopy.

"Is it going the same way we are for the same reason?"

"Maybe, maybe not. He's bigger than us. Mark, this might be somebody trying to stop us from reaching the starship."

Mark broke out in a sour sweat. The idea of leaving Earth had given Mark nightmares in plenty, but not even the worst one had included a scenario like this.

An instrument beeped shrilly. Ev muttered, "And that's a signal from somewhere. . . ." Ev cross-checked the strange signal. "Somebody's feeding us a false navigational signal. I think it's our anonymous friend. Well, the Merlin's smart enough not to buy it." Ev patted the instrument panel affectionately.

A moment later, the jet dived. Mark clutched the mouse carrier, from which came alarmed squeaks.

Ev cursed. "They're trying to force-land us!"

"Can they?" Mark almost shouted.

"Get the hell out of my fly wires!" Ev punched in a reprogramming sequence.

Desperately Mark wondered if being forced to land in San Antonio would be so bad. It would mean not having to leave his world after all, and a final end to nightmares and frantic plans, and getting out of the sickening air.

The Merlin leveled off. A radio transmission must have come to Ev through the slender headset he wore. His face looked startled as he listened to whatever was coming through the earphone. With abrupt motions of his hand, Ev changed the radio receiver to a different frequency. "It's a Pennington corporate jet," he said to Mark. "I thought we got away from that company spy before we took off. Apparently not."

Ev sent the Merlin into a climb, a steep one. In their carrier, the hapless mice lost their footing and slid across the carrier's floor, scrabbling for footing.

"Are you important enough that they'd send a company jet after you?"

"Yes," Ev said curtly. "So are the mice."

Urgently Mark asked, "What can he do to us?"

"I don't know and I don't want to find out. Sit tight. I'm going into afterburner."

The climbing Merlin's nose already pointed toward a star above the red horizon. The engines screamed and the jet leaped toward the star. Its rocketing ascent pushed a load of gravity on Mark. He sank deep into his seat.

Ev grunted, "*Ha!* Can't catch us now!"

Mark felt his face sag on its bones.

"Pushover!" Ev's jet dipped its nose back toward the horizon. Mark's stomach tried to somersault. A distressed noise escaped from him.

"Swallow to get your innards back on line," Ev said. "*Damn!* He's coming after us—let's see you do *this,* you bastard!" Ev's hand twitched on the sidearm control stick.

Urgently wanting to follow what was happening, Mark looked out the window to his right. He was shocked to see the whole, wide purple sky in that direction. The jet was pivoting on its left wing.

The Merlin bolted toward the southwest. Mark's stomach settled, squashed, into the wrong internal place. He clamped his teeth against retching. Leveling off, the jet streaked across darkening land with its nose pointed just south of the setting Sun.

"I outmaneuvered him!" Ev crowed.

He looked at Mark. "Feeling OK?"

Sweating profusely, Mark snapped, "No! Them either," Mark added, meaning the mice. "I think they're dead."

Ev hastily took the mouse carrier and peered into it. "They're OK. They just fainted, the climb in addition to the low cabin pressure got to them. Poor mice," he crooned over them. "If I'd meant you to fly, I'd have given you wings."

Making a last-ditch fight against airsickness, Mark stared at the horizon with its brilliant puddle of Sun. Shades of red stretched from horizon to zenith, flaming ocher to vermillion to maroon. Mark saw the spectacular sunset as a barrier, forbidding and insurmountable.

The Merlin was a very expensive and capable private jet, but not orbital. They might reach Star Field. But they would never make it past the red sea of air that was the sky.

Mark looked pale but relieved, leaning back with his eyes closed. Ev concluded that Mark was through being sick. "Since I wasn't replying to him, and since I outmaneuvered him, the Pennington jet gave up and flew back to San Antonio," Ev told Mark. "We're approaching the Mexican border now. I don't think we'll have any more trouble in the air. That was what pilots used to call 'yank and bank'! It's not recommended for this jet, but she turned the trick beautifully, didn't she?"

"I still don't like flying with you," said Mark. It was his first complete sentence in the last fifteen minutes.

"I had to evade that guy. I'm sorry."

Ev was aware that he did not sound sorry. Exuberance had leaked into his tone, for in flying, Ev was very much at home. People on Titan rarely traversed the nitrogen ice fields on the surface of that world, but flew everywhere instead, using blunt-winged craft to ply Titan's dense atmosphere. Ev clapped a solicitous hand on Mark's shoulder. "Feel better now?"

"At least we made it to Mexico," Mark muttered.

"So we did. But since the Desesperación, the government of Mexico is for most intents and purposes a puppet of the U.S. The U.S. government pulls the strings and makes things happen in Mexico. I won't be surprised if there's trouble of some kind later today."

Mark groaned.

"Don't worry. The Foundation won't be surprised either," said Ev. "We're more prepared than you realize."

Below them now was the dammed Rio Grande, a trickle finding its way from one jagged drying lake to the next. Ahead, the setting Sun glared on the Mexican desert. "God damn it all," said Mark suddenly. "I remember the first starship, when we were kids. The videos of the ship under construction and the crew in training, blue uniforms and all. Everything was grand and heroic. Just before they left there was that ceremony, broadcast to the whole Solar System. Flags and music and holo-convocation and all. When Berry left, on the second starship, I guess there were some critics, one political party disapproved of it, but there was still a ceremony. Why do *we*

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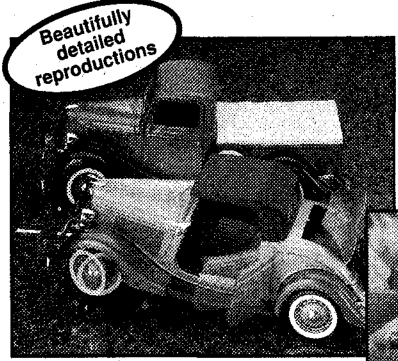

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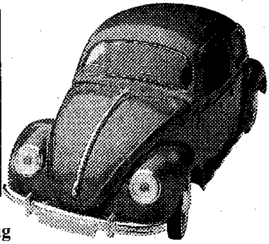

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have to scheme and steal and run away at night?"

Ev pulled a sheaf of papers out of the personal-effects pocket beside the pilot's seat. He extended to Mark the flimsy netnode printout pages from *The Wall Street Journal.* "Scan that editorial."

STARSHIP BRAIN DRAIN said the headline.

Mark grunted. "No wonder you printed it out. It's about your hero, Norden."

"Read on." Ev had practically memorized the article. It held that Norden's departure on the last starship, seven years ago, had constituted an unacceptable loss to science and civilization. Norden exemplified the young scientists who had deserted the Earth for the stars—some of the brightest, best-educated, and most highly motivated minds of their generation. The tap had been left open and irreplaceable brainpower had drained away. This time, the *Journal* declared, it was the responsibility of government, industry, and citizens to firmly close the tap. The starship should be stopped, the departure of Earth's best minds prevented. By whatever means necessary to do so.

"I'm no Joe Norden," Ev said frankly, when Mark seemed to have reached the bottom of the page. "But I'm good at what I do. You're a very good ecologist. Read the part about disease."

Mark read aloud. " 'If a sudden new disease selectively struck down a comparable fraction of the first-rate talents and first-born achievers in the upcoming generation, an outcry would be raised around the world, and there would be an urgent search for amelioration and cure.' "

"Harsh metaphor, isn't it?" Ev sighed.

Encountering clear-air turbulence, the jet bounced. With slight movements of the control stick in his hand, Ev shepherded the jet through the bumps in the air, into smoother air. Beside him, Mark held on to the carrier with its precious mice, buffering the bounces for them.

Clouds flecked the land below, small ones, as round as dry cottonballs. Few people still lived in the barren land under the cotton clouds. Half the population of Mexico had pressed into the slightly greener plains of North America, an unstoppable surge of desperate humanity that had been named the Desesperación.

Mark watched the wasted land unfurl under the jet's gleaming canard. "Why the hell are we going to look for a world across the stars to try to terraform it? We could restore this one more easily. There's so much here to work with even now. We can clean up the pollution and rebuild degraded ecosystems. Why not?"

"Politics, religion, war, and overpopulation," Ev said patiently. After all, the two of them had had this discussion before, with each other and with Miraly. "The mindless horsemen of environmental apocalypse. In my opinion, the worst of them is politics. Or, I should say, politicians to whom their own power and prestige is their first concern, all else be damned."

Through gritted teeth, Mark said, "I hate politics."

"I can hardly blame you," Ev said, remembering the disaster of the prairie.

"Did you see the way the editorial concludes?"

"Yes."

Mark read it aloud anyway, his tone shocked. " 'Mr. Kristeller, the Director of the Genesis Foundation, should return to Mars. There he can contribute to the expansion of Earth's resource and economic base, rather than organizing the modern-day equivalent of the Children's Crusade.' "

"That's inflammatory," said Ev.

"Do you really trust Kristeller?"

"Yes."

"But he's a Martian."

Ev twitched the corner of his mouth disapprovingly. Evidently, Mark was upset enough not to remember—or not to care—that his present company was Titanian. "Actually, Kristeller is a biologist who got blacklisted in the industry here and took a job on Mars four decades ago. I guarantee you he knows how hard terraforming is—and that Mars isn't the right place for it. He says it would go faster on an Earth-like world, and he ought to know. You're right in a way, though. Kristeller is a naturalized outworlder. Living away from Earth makes a person develop a certain perspective." Ev added, "And I'm a Titanian. Compressible tentacles concealed under the suit, remember?" Ev wiggled one eyebrow, a little trick that Ev had discovered when he was the small boy called Bem.

"Compressible wings, maybe," suggested Mark, with a wan smile. "I'm sorry. I forgot."

The Sun seemed to move up in the sky. Flying faster than nightfall, the Merlin was catching up with the day. The land below folded up into a mountain range, brown and deeply shadowed. Ragged peaks exceeded the altitude of the jet as it angled through a pass between the peaks. Ev could have flown higher, maybe should have, to conserve fuel; but he did not want to invite radar detection quite so blatantly.

On the other side of the mountains, the jet soared with a lift in altitude. "Updraft," said Ev, "the wind from the sea hits this range and rises. The Gulf of California is in sight, and so is something else." Squinting, Ev pointed to a thin dark line above the shining arc of water on the horizon. Perfectly straight and vertical, the line bisected an otherwise irregular, fractal panorama of hills and cloud-studded sky. It was Star Tower, and it went past the top of the sky, all the way to the starship. Ev's heart beat faster.

"Oh, God, it's tall." Mark's voice sounded strangled.

Ev gave a surreptitious glance toward where the used air-sickness bag had been stowed. "Think of it as a giant beanstalk."

"No," Mark objected. "Remember how the fairy tale ended?"

Ev laughed. "It won't fall down. Not yet."

But as he flew on toward the Tower, Ev sobered. This wasn't a fairy tale. It was less like a fairy tale than he had ever expected. The back seat of the Merlin was empty. No Miraly.

Ev scanned his instrument panel in a pilot's crosscheck, an active pattern to avoid instrument fixation. He felt empty inside, like the Merlin's back seat, with an aching void behind the busyness of flying and planning. He could not ever remember feeling this way before. Was this how Mark had felt when they killed the prairie? No wonder Mark had been so distracted and unhappy since then. Emptiness where the heart should be was like a black hole, an ache that bent your fabric of thought and feeling around it.

Now, with his destination in sight, in the lull between the uncertainty of getting this far and the *terra incognita* that was the future, Ev's mind returned to last night. His last night with Miraly, and he hadn't known that was what it was until the end of it.

Miraly had been at work in her hospital all day yesterday, and well into the evening. In the private peace of the home he shared with her, Ev had put on his Virtuality visor and gloves and became a spider on the world's computer web. He followed electronic links of his own making to visit what interested him most.

Lurking in the Netnews-casts, he saw protestors and their angry hand-lettered signs, listened to learned commentators discuss the impending Supreme Court decision on the law against removal of wild matter from natural areas. He checked the ship's tome, and saw that the announced departure date was unchanged, two months away. He also found the clue that told him, and anyone else who knew what to look for, that was untrue.

The ship had been christened. Its name was *Primordium*.

The naming of it meant that it would leave tomorrow. Tonight would be Ev's last on Earth.

Knowing that, Ev followed the web to his favorite places, Paris, Rio, and Ares City. He gorged himself on the sights of the Seine River and Carnival and the dour red walls of Valles Marineris, heard the woodwind music in the Brazilian streets and the thin Martian wind in the solar arrays of Mars One, and talked to people he knew and did not know, wishing them *bon jour, buenos días,* and on Mars with its long year marked by the imperceptibly slow circuit of the Sun in the pale sky, "Bright Day!" Then he left the Web and signed off the Netnode.

Web-decompression always took a while: readjusting to sights and sounds that were given, not chosen, and basically static, not in the polysensory flux of the Web. He focused for a while on the subtle blue colors in *Ladies of the Lake.* Then he went to the kitchen to inhale the lingering aroma of coffee from this morning and chicken cacciatore from last night.

The technology they were taking to the stars was old, Ev reflected. Old and reliable. Space was a terrible place to have a sophisticated black box that might stop working. At the distant star in Sagittarius that was their destination, they'd have computers all right, but not universal, ubiquitous, polysensory access to the Web of so complicated a world as this. Mark would be right at home. Ev would miss the excitement.

Miraly came home from the hospi-

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tal late due to an emergency. Ev presented her with chocolates—her favorite kind, Swiss confections with hard shells and creamy centers. He began kissing her while her lips still tasted of chocolate. They made love. As much or more than ever before, he thrilled to the feel of her warm breath and cool skin.

At last, she looked at the clock—four A.M. "It's today, isn't it?" Her voice was low and serious.

For the first time in his life, Ev was at a loss for something eloquent to say. He tried and finally failed to think of something better than, "It's your last chance to leave."

"No, not mine. Ours. To go or stay together."

"You're still staying?" he whispered.

"Yes. And you're going." It wasn't a question.

Realization shot through Ev, and left a sudden shaft of hot emptiness in his soul, like the scalded air left behind by a bolt of lightning. "Why?!" he shouted.

"I've told you many times!"

"I don't understand!"

"Don't yell at me. Stop it!"

Ev clenched his teeth to silence himself. As long as he had deluded himself that Miraly would come with him, it had been easy to plan to go to the stars. Now it was a gaping, awful prospect that he wanted to rail against.

Miraly said, "Listen to me. Forever after this, Earth will know there are other worlds with intelligence on them." Her voice sounded solemn and almost ceremonial, resonating in the room's semi-darkness as though it were a theater, rather than a bedroom. "Finally, there will be no doubt that there is other intelligent, civilized life in the Universe. Not under our control. I think it will change the politics, the ideas, the whole way civilization is headed. I can tell by how hard they're fighting it."

Ev shook his head. "Fighting hard and dirty. I can't see any sense in staying through that."

Miraly sighed. "Dear sweet Mark works on grasses, and you work on genes. Neither of you have a lot to do with generations."

"You're being about as clear as the atmosphere of Venus," he said, with a pained grin which there was just enough soft light from the electric candles for her to see.

"Oak trees generate new oaks. People have children who grow up, and neither oaks or people are like century plants that grow for a long time, go to seed, and keel over dead. Earth is more like an oak or a human."

He groaned. "For God's sake stop being so Venusian—what do you mean?"

"Some people hoped the outplanet colonies could be like children of Earth who grow up. But the Moon and Mars and Titan never will be full-grown worlds like Earth. Yours will. Ev, people do sometimes try to hang onto their children forever. But having full-grown children who leave you and live out there, apart from you, maybe stronger and wiser than you, makes a difference in how you live. Knowing that other civilizations exist out there will make a difference for the Earth."

"And that's why you can stand to stay?"

She nodded. Strands of her dark hair loosely framed her fine-boned face, and made Ev's heart pound faster at her beauty.

"You never explained it like that."

"I've been thinking very, very hard these last few weeks."

Ev groaned again. "I understand what you mean now, but I can't buy it. I can't accept it."

"The reason I can, is because I'm not going. You are. You have to have your own truth, and it has to be about the new world, not the old one. Ev, what is it?"

"What?"

"I mean exactly what I asked," she said crisply. "Why are you going?"

Ev got out of bed, threw on his silk pajama bottoms, and paced in a hot sweat. He was Ev Reynolds, first the boy and later the man could always say something plausible. Not tonight. Tonight, what he said had to be not just plausible, but true.

Mark wanted to husband a new world; he also needed a simpler world than this Earth, even if a harder one. Ev respected Mark's motivations. Certain other people were not attached to much in this Solar System, and were out for sheer adventure or a clean slate in life—motives that had gotten a great many strange lands explored in the history of human life on Earth, but not Ev's motives. Then there were the people who gave Ev the general impression of rats leaving a sinking ship. It had to be a better thing than that for him.

"It stopped being a game for you a while back," said Miraly. "I realized you'd go. But I still don't know why. I'd really like to know." She paused. "Ev. I wasn't going to tell you this. But I think it's the only way to make you tell me why you're doing this. And maybe tell yourself. I haven't used birth control for weeks. And I'm pregnant."

Stunned, Ev halted his pacing. He couldn't keep his voice from rising to a near-shout. "To make me stay?"

"No, so that your father and I have part of you to remember you after you're gone!" She put her arms around herself, not him, and the gesture tore at Ev like a bandage coming off a wound. It was the first motion of her pulling away from him.

In pain, he asked, "What do you want me to do?"

Of all women, only she could have said what she did next with no acid in her tone, just level honesty. "Tell me, what am I going to tell your child?"

Ev could not reply. They held each other in silence for the slender remainder of the night, tightly. In the morning she left for work in the hospital in Galveston. Ev waited for the call from the Genesis Foundation.

Visiting the bathroom, Ev stared at himself in the mirror. He looked haggard. And this morning, of all mornings, he saw the first faint wrinkles of age in his skin.

Ev had always tried to overlook wrinkles in women, and disparaged them in other men. *What you get for living too close to the Sun. Gravity's calling card,* he called them. But today young wrinkles stood in his own face to tell him that the irresponsible kid he had been was no more. He had to do something with his life, something more permanent than his physical being.

I know I have to go. But how can I explain to her? And to myself? Waiting, he stared at the *Ladies of the Lake,* as if to ask the picture or the stars: *what is my why?*

Ev let himself slide into the wide picture, imagining the scene as if he were the first man to explore that nameless world with new stars in its sky reflected in the nitrogen lake: starry Sisters in their swaddling nebulosity, and the other stars, red and blue and yellow, that belonged to the same young open cluster.

Lost in the painting, Ev imagined climbing one of the sharp islands that ringed the nitrogen lake. He chose the island or peninsula in the left edge of the picture that had a low saddle-back profile, climbable in the world's relatively low gravity with easy, careful strides. He wore a cold-moon spacesuit. There was the inhalation and exhalation of his own breathing in his ears, and static—the soft radio hiss of atoms of gas in the Pleiades's nebulosity.

Since this was imagination anyway, he let his boots make footprints in the nitrogen frost. The footprints were dark and graphic—the frost was thin; under that layer, the mountain was sooty with stardust, grains with embedded glassy traces, primitive organic compounds, everything that had been swept out of space by the radiation of the new Pleiades and clotted on the skin of this planet.

At the top of the ridge, Ev turned his face up to the shining skein of stars stretched across the black sky like the bright banner of creation itself. So it was when my own Sun formed, Ev thought. In its day it was one of a cluster of stars. They condensed out of thick dust and gas that had been blown into the Universe when some of the First Stars turned into novas and supernovas.

I started in the stars. I am atoms forged when supernovas died. I am Earth distilled from the dust between the stars. "For you are dust and to dust you shall return."

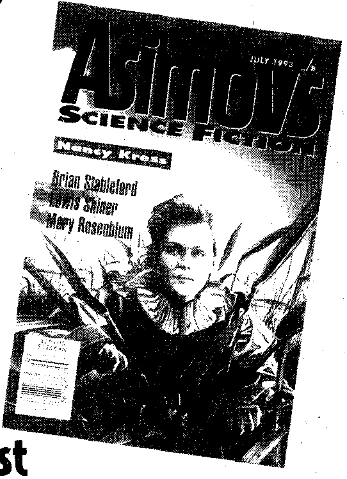
Startled so much that his imagination fell back out of the Pleiades print, Ev took a deep breath. His mind, strained with lack of sleep, gingerly cradled the new, sharp idea that it wasn't exile but homecoming that he was poised on the brink of, return to the once and future glory of the stars.

Then the Netnode trilled, and the contoured tone told him that it was the Foundation calling. His return to the stars had begun.

The Gulf of California flashed beneath the wings, a narrow sea of glare. Mark hardly noticed. His eyes were glued on the base of the gigantic tower that was the axis of Star Field, Baja California.

The Star Tower had been constructed here in case it fell down in whole or in part: it was better for it to fall into shallow sea than onto possibly inhabited land. Mark's heart fluttered. It hadn't fallen yet, he reminded himself. It had already launched the two earlier starships on their journeys.

Runways described a geometric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pattern around the foot of the tower, buzzing with arriving traffic. Some of the aircraft landed the old-fashioned way, rolling to a stop. Newer types landed vertically, touching down like dragonflies in a whirl of delicate wings.

Listening to the earphone of his headset, Ev frowned. "Control wants us to hold off while they figure out where to let us land. I'd really like to ask for a close-in vector around the Tower, instead of the regular hold, so I can get an eyeful of the thing."

"Go ahead. I don't have any lunch left to lose."

Receiving the vector he wanted, Ev banked the jet around Star Tower. "Reminds me of flying around Titan station, but this is a bigger machine—much, much bigger—in a deeper gravity well. In fact, it shows you just how deep Earth's gravity well really is."

Ev tipped the jet's starboard wing down. Mark looked into the ravines of the tower's vast buttresses.

With a flip of the wing, Mark's stricken gaze traveled up—and up—and up. Star Tower lifted past some cumulus clouds toward the edge of the atmosphere.

Swinging away from Star Tower, the jet soared out over the Gulf of California. Green salt water extended far to the south. Shallow, with pale sand underneath, crinkled with waves, the water resembled a celadon glaze. Mark longed to be down there. To glide across the warm shallow sea under his own paddle power, wavelets lapping the prow of his kayak in quick succession. The long dark shadow of Star Tower lay across the water.

Near the edge of the Gulf, some small ships and barges were conspicuous, dark spots on the bright sea. They clustered around the mouth of a narrow channel cut into the desert in the direction of Star Field. With shiny, curly wakes, some of the ships seemed to be circling aimlessly. "Now, what's all that?" Wary, Ev did not take the jet down to look more closely. He snapped on the jet's Netnode, quickly asking it for a search of HEADLINE NEWS RE TRAVEL, INTERNATIONAL, INTERPLANETARY, INTERSTELLAR.

Ev paged through the headlines. " 'Supreme court rules against removing plants, animals'—that we knew about," he murmured. " 'Genesis Foundation to Appeal.' Sure. *In absentia*." Then Ev said, "Damn!"

US PRESIDENT DENOUNCES GENESIS FOUNDATION

Through clenched teeth, Ev muttered, "He hates us. He's an old, powerful politician. He wants to keep the world and the future in his control." Ev quickly paged on.

The news-node in San Diego, California, reported enormous traffic jams at the U.S.-Mexican border. Mexican customs had initiated vehicle and cargo inspections on an unprecedented scale.

Ev said, "I see. The president leaned sufficiently hard on Mexico to ensure its cooperation in hindering us. That must be the Mexican coast guard down there, having words with ships trying to reach the Star Field canal. Trying to delay them."

The opposite shore of the Gulf was clearly visible, low brown ridges of dry land. Before they went that far, Ev sent the jet into a high, wide turn to head back toward Star Field.

The Netnode beeped shrilly. BREAKING NEWS: SPACE LAUNCHER MISFIRES.

The La Jolla Launcher had misfired today. The Earth-to-orbit payload launched by the long electromagnetic gun streaked into space on the wrong trajectory, accidentally aimed too low and too far south. The errant payload crossed the restricted space above Star Tower, missing the starship by some seven kilometers.

"That was no accident," Ev growled. "More like a warning shot across our bow." He turned off the news and increased the Merlin's airspeed.

Now the Sun was setting in their eyes, again. The Tower loomed, dark and endlessly high, against the red sea of sky. Strobe lights raced up the Tower's beveled flank toward its heights to warn aircraft against collision.

Ev said, "Damn it, they still can't give me clearance to land on the field. Too much traffic in line ahead of me. But I'm running out of fuel. The afterburner ate a lot." Ev fumed. "I could declare an emergency and beg for a slot, but I don't want to."

"So land on the desert," Mark replied.

"Too much loose sand. Landing on it would sandblast the jet and Dad would kill me."

Mark scanned the terrain. Roads and railways spidered away into the dim dusty distance of the peninsula. There were empty spaces in the interstices between roads and rails. "See that high spot by that dry wash? It's the closest flat ground that isn't a storage yard or a runway."

"And Dad isn't going to have the chance to kill me, is he?" Ev murmured. He conferred with approach control, speaking into the mouthpiece of his headset. Then he said, "They agree. Here goes."

The Merlin hovered down toward the landing place. Mark noticed a jagged outcrop and urgently pointed it out to Ev. Ev made the jet skate to one side to avoid the rocks then lowered the jet toward the ground. The jet wobbled unsettlingly in the air. "Lot of convection currents," Ev said, his words terse. Sand sprayed up past the canopy.

Ev cursed vehemently just as the Merlin settled down with a thump.

"What happened?" Mark demanded. "Did we almost crash?"

Ev snatched off his headset and glared at it. "I was just informed that there's a one-week customs embargo for plants and animals being taken into Star Tower! My mice are OK. They're patented. Your stuff—I don't know. They'll probably take your seeds away."

Mark sat still. After the flight, the silence seemed sudden and extreme.

Mark thought, *No*. The new world should have a chance. The bluestem and *Helianthus* would help that chance. Opening up the mouse box, Mark poured the seeds into the feeder. The mice squeaked uneasily. "I can tell the seeds apart later," said Mark.

"Even if they've passed through the mice?"

"Mice never digest all the seeds

they eat."

"Good idea." As an afterthought, Ev said, "They haven't ever eaten anything but mouse chow. Typically, invented organisms aren't adventurous enough to try anything new."

Mark stuffed the labeled vials under his seat. Ev hopped out to inspect the Merlin's sandblasted underside.

The hot desert air smelled sharp, sandy with fine particles raised by the jet's landing. They had landed a good two miles away from the Tower: it stood on the other side of a wide dry wash and a storage yard full of cargo containers. According to the Tower control, a Land Rover would come to get them. As soon as one could be spared.

Mark felt better, less queasy and more decisive. "We've got to hurry," he said. "It's not that long until the deadline. We can walk."

"And leave the Merlin?"

"We were going to anyway," Mark pointed out.

Mark's legs wavered under him. He made them work, aiming himself toward the distant tower. Cacti and stringy succulents studded the barren ground. The sky overhead was not the greenhouse overcast it had been over Uptown Houston. Orange and red flooded the western half of this desert's sky. To the east, several stars punctured the cloudless purple. Mark imagined a star world with even less ozone than the Earth had now, a climate with more severe extremes, a desert qualitatively different from this one: newer and nowhere softened by life.

The dry wash lay across their route to Star Tower. "That looks rough," Ev said, sounding reluctant.

"It is." Mark picked out a trail to the bottom, down a bank sharp with stones. Ev exclaimed in dismay as the stony ground shredded the edges of his expensive shoes. Mark's light hiking boots, his chosen everyday footwear, fared better. The last few yards were an uncontrolled scramble.

Mark gathered himself up from the sandy floor of the wash. Ev slapped sand from his suit.

A dry wash: but not always dry, and that made all the difference in the world to the organisms here. Glancing around, Mark noted mesquites and acacias on the wash banks, the serrated blades of agave, also several small grasses. Lizard and rabbit tracks crisscrossed the rippled sand floor. Plants grew in the wash with its occasional water. Animals lived and foraged here on account of the water, the plants and the shade. This dry wash was a lifeline in the desert.

Go to a new world. No jungles yet, no prairies, no forests. Just empty seas and hot, dry continents, infrequent rains that flash away in floodwaters unchecked by vegetated ground. Find a watercourse. Introduce living things like these. The ecology might creep down the watercourse, and from the watercourse, the green blush of life might spread out into the barren land. With luck and work, terraforming might succeed.

For the first time, Mark felt hope. Halfway across the wash, Mark picked up a stone, water-worn smooth, a pleasing dull green color. On impulse, he put it into his pocket for a talisman, a last touch of Earth. A negligible, maybe-fifteen-gram addition to his personal effects.

Mark enjoyed using his leg muscles on the way up and out of the arroyo, and moved fast. Behind him, Ev commented, "I can tell you're feeling more like yourself now."

Mark always felt like himself when he had the chance to walk somewhere. A woman professor—Samantha Berry? No, Anna, of course, in that strident Dutch-accented tone of hers—had once joked that Mark would walk to Mars if there were a way. He now found himself walking to the stars.

Mark had seen pictures of the Star Gate before. Pictures had not prepared him for the reality of the foreboding arch in the immense tower.

Graffiti marred the stone-sheathed wall of Star Gate, including, ABANDON ALL EARTH YE WHO ENTER HERE. "Charming," said Ev. His collar was open. And he looked wilted.

Inside the tower were crowds of people, a din of activity, jarring after the quiet of the desert. Ev made sense of it before Mark did. Ev muttered, "Looks like Mexican customs gets to screen what's going through their country to the stars."

Hundreds of would-be star travelers had arrived by air, land, and sea only to find themselves in the bottleneck of customs. The travelers were angry and agitated.

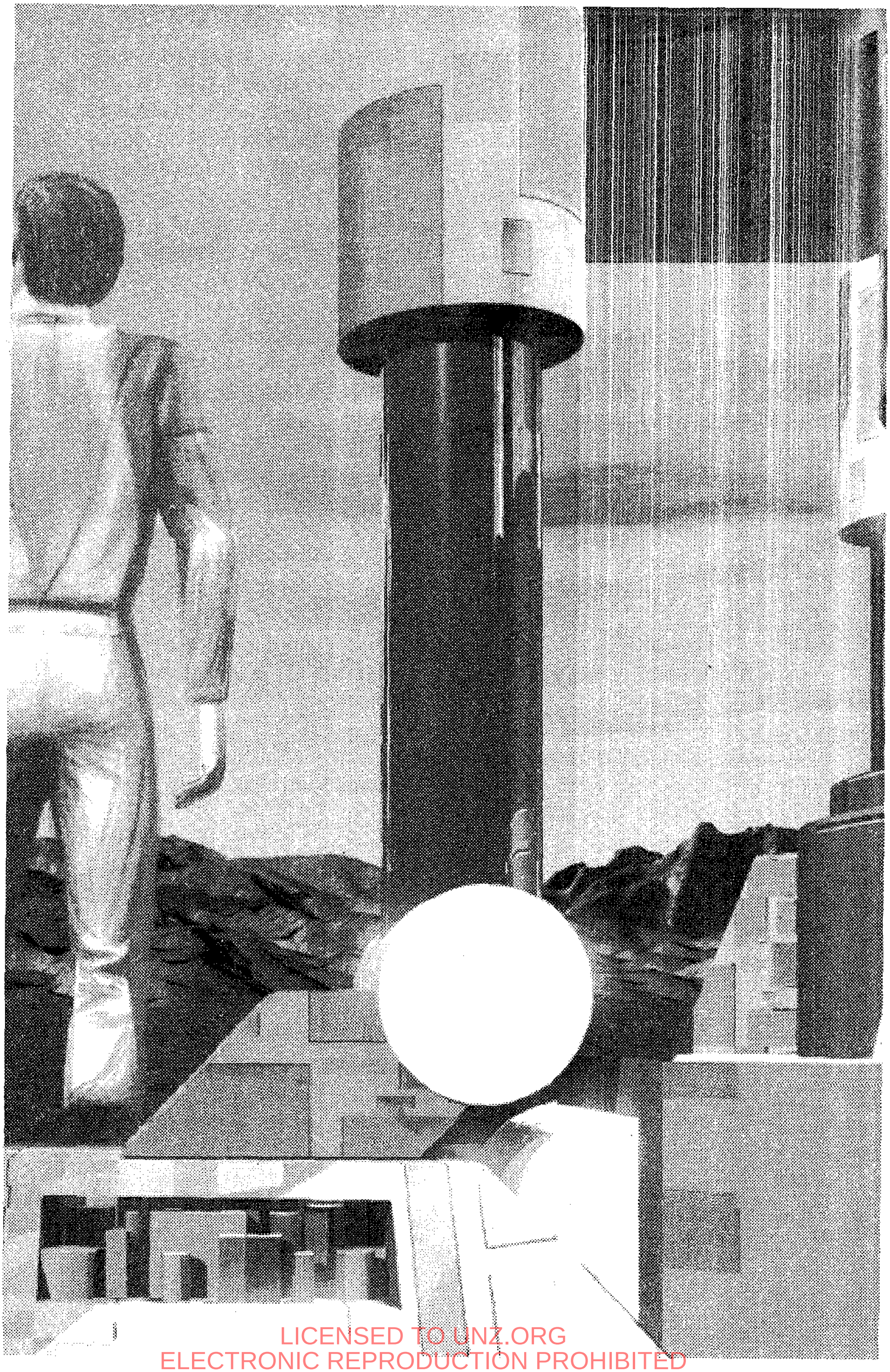
Mexican Customs was unsure why it was necessary to confiscate and embargo biota, or just how to define "biota," but had definitely decided to seize live animal carriers and containers labeled as animals or plants. An alarming pile of such containers occupied the back corner of the screening area, living things wanted—needed—by the starship.

Some men and women in plain clothes stood behind the customs checkpoints. Anglo-Saxons or blacks, they wore a uniform air of grim efficiency, and seemed to have a dangerously good idea of what they were supposed to look for and why.

Ev let his breath out between his front teeth in a hiss of dismay. "There's no velvet glove on the iron fist today. No consideration for the illusion of Mexican sovereignty. Those are the president's men—Federal Marshals. Whatever happens, remember—the marshals' authority has limits, at least until martial law is declared, which it hasn't been yet. They can't arrest us because we haven't broken any laws."

Ev shouldered his way to the front of the line like an eel, towing Mark behind him. Mark stepped on toes and bumped into elbows. Ev showed the harassed Mexican Customs agents his mice and the patent documents to prove the mice belonged to him. He offhandedly identified the grass and sunflower seeds as premium mouse chow. Cheerfully he turned his tailored pockets inside out to demonstrate their emptiness. Customs waved him through, mice and all.

But the customs agents checked Mark's identity license with interest, discussed and doublechecked it. One of the ominous suits, the marshals, gravitated over for a look at the li-



cense and at Mark. The marshal gruffly told customs to take Mark aside.

Mark's stomach knotted. Directed to the back corner of the customs area, he had to wait while the crowd filtered through customs and dwindled. He seethed, but felt no more free to run away than were the confiscated small animals in their cages around him. Then he was escorted to a small featureless room. Oddly, it was not the marshal who interviewed him; the marshal guarded the exit, silent and intimidating. A customs agent directed Mark to empty his pockets onto a table. The agent examined his belongings. "What is this?"

"My notebook computer," Mark answered, voice choked with tension. The marshal's eyes bored into his back.

"And this?" The agent picked up the green stone. "An egg?"

"*No.*" Mark could not keep disgust out of his voice. The customs agent met his eyes with a mild glance that slid over Mark's shoulder to the marshal.

Despite what Ev had said, Mark expected the marshal to arrest him, to handcuff him. Yet the marshal said nothing.

Mark never wore a watch. He relied on excellent time sense instead. A clock on the wall was conspicuously placed. It was also wrong, at least half an hour slow. Mark suddenly realized that the marshals might have decided that certain kinds of scientists were worth the effort of delaying until they missed the ship. With no legitimate authority to detain him, the president's men had resorted to trickery.

Mark turned to confront the marshal. The big, hard-featured man glared at Mark. "Your clock's slow," Mark announced. "I'm leaving now. You can't legally keep me here." His voice shook. "You can keep the things I had in my pockets. Except for this." He picked up the green pebble on the table. "Which is just a stone. There's not even any moss on it."

The marshal scowled. Mark's insides clenched, but he shoved past the marshal anyway. The marshal shoved back, sent him bumping hard into the doorjamb. Mark ricocheted out into the deserted corridor, and the marshal did not pursue him. Mark hurried toward the heart of the tower.

At the far end of the corridor, Ev paced. Behind him was a large portal. Jerking his thumb into the doorway, Ev yelled, "It's about to leave!"

Mark sprinted. The two of them scrambled inside just before the doors closed. Ev turned around and flung an arm around Mark's shoulders. "*Touchdown!*"

Buoyantly Ev led the way up an escalator to a spacious room, appointed like a hotel lobby and laid out around a huge column with twelve blank sides. Twelve outer walls echoed the central column. Each wall had a large window.

"Welcome to the televator. This is the observation deck," Ev explained. "You don't have to look out if you don't want to." Presently there was nothing to observe beyond the windows, just the walls of the tower. Avid to see the sights of the trip up, Ev made a beeline for a soft, deep armchair beside one of the picture windows. He offered Mark the chair. "You'll be better off sitting down for the ride."

Mark sat. Once again the mouse box rested importantly in Mark's lap. Scratching noises came out of it, and Mark peered into the box. "All three are eating."

"I did a good job with them. They function normally."

It wasn't that hard to genetically engineer mice that had one or several altered traits, but otherwise were normal. Ev always said mice were easy. "They're not just patented fancy mice, are they?"

"No." Ev spoke in an undertone, still secretive, conscious of the increasing crowd of people in the observation deck. "Their chromosomes are artificial, containing a complete set of mouse genes, plus a great deal of surplus DNA and, of course, genes which specify that the surplus remain unexpressed. The unexpressed DNA happens to be that of other species from the company's gene banks."

"You mean you stole genes?"

Arms crossed, Ev radiated self-satisfaction. "It's amazing how much DNA can fit into the chromosomes of a mouse's cell. I filched the genetic code for several hundred assorted species."

Mark felt a gentle surge of inertia that pushed him into the plush seat. The televator was ascending. The walls of the tower blurred, making the vertical rows of lights turn into beaded strands. Ev settled onto the generously wide arm of Mark's chair, the better to see out.

The deck had filled up. There was conversation in the background, sporadic exclamations louder than the general conversational buzz.

"We're the last off the pad," Ev said, "Look up through the skylight. You can see the next to last."

Another televator was going up too, higher than their own and on the opposite side of the tower: a twelve-sided cylinder with a twelve-sided hole in the middle of it, through which ran a barely visible, vertical wisp of smoke. There were other smoke streams in the tower, a dozen in all. Ev explained, "It's a vacuum here inside the Tower. Those particle streams are ionized molecules—to be exact, Carbon-60, buckminsterfullerene. The streams flow up to lift the televators or cushion them on the return. There are five televators going up ahead of us tonight to the ship. The streams also keep the ship up. It's riding on the particle turnaround—on top of the whole thing."

Mark could see no other televators beyond the one just above their own, only the tower walls, dwindling to an apparent point of closure. It was a horribly long way up, he thought, with four televators and a starship out of sight in the vertical distance.

Ev reflected. "C60. Stardust. We are being lifted up by the same kind of soot that exists in cold dust clouds between the stars. It was also the ion propellent for the Athena series of star probes back in the 2030s and '40s. Appropriate, isn't it?"

That other televator rotated. So did their own. Theirs was just like the one just ahead of it, a torus in midair, slowly circling a thin stream of soot. That was why this observation deck was centered on a column with twelve blank walls: the particle stream went through the middle of the televator, and all three stories of it were being lifted up by insubstantiality, up, and up. Little spiders of panic danced along Mark's spine. "Ev," Mark choked. "Are we safe?"

"I think so. The president can't do anything as crude as turning off the particle streams. Or shooting down the ship. It was chartered as an international effort. More likely, he'll send the Space Force up from the Earth bases—from the White Sands and Cascade bases. That is," Ev continued, speaking softly, "he'll so decide and so order, but I don't think we have to worry about it."

"No?"

"No." Smiling slightly, Ev made a hand motion which Mark interpreted as, *wait and see.*

Ascending at an already terrifying speed while rotating, the televators were still accelerating. The beaded strands of lights on the wall of the tower twisted into helixes. To Mark's alarmed fascination, the top of the tower was now close enough to appear as a definite circle full of stars.

Ev followed Mark's gaze. "Ever hear the one about being able to see the stars from a deep enough well?"

The televator rocketed out of the top of the tower. Mark instantly recalled that the Star Tower terminated above the thickest layer of Earth's atmosphere. The particle streams kept going. So did whatever they carried. From here on up, this machine was called the Space Fountain.

Below, but not quite below them, the edge of the planet glowed crimson with the Sun disappearing behind it, the red rim of the sea of air which they had just crossed.

And now that they were out in the open, somebody could turn the Fountain off. Or shoot the televator down with the La Jolla Launcher. Or—

"Ev! Why's the televator still spinning? Is it under control?"

"As far as I know, the rotation is just for the view, which is magnificent. Relax and enjoy it. If I were you, though, I wouldn't look down. Or up," Ev added, by which time Mark already had.

Above, in unbounded, black, starry space, a square platform hung, suspended. The flanks of the starship *Primordium* bowed past the platform's edges. In an inverted bowl under the platform, the Star Tower's particle streams were magnetically turned around. Only the thrust of the turnaround, only the turning soot, kept the platform up. And ominously, like a loose falling object, the platform and ship parked on it rotated.

It was the televator rotating, Mark reminded himself, trying to clamp down his jumpy nerves.

"Don't look up. Look outward," Ev reminded him.

But gazing out stirred up feeling deeper than simple phobia, and more painful. Space was black, with stars, like night. It was eternal night out here. Mark had left blue sky behind, with white clouds, celadon salt waters, and the rosy morning and evening colors of the Earth's Sun on the horizon—all behind him, in his past and irretrievable. His chest tightened, making it hard to breathe.

Rotating, the televator swung them away from their destination and back over the face of the Earth. Sunlight brightened Asia, but night had fallen over North America. The wide land was plainly fevered. Cities showed up as yellow splotches, connected by glowing trails of electricity like the tracks of a cancer's metastasis.

Talk in the observation deck quieted. People were clustered by the windows, watching. Some cried, sniffling sounds audible in the absence of chatter.

With thumb and forefinger Mark squeezed the inside corners of his eyes to hold in tears. He whispered, "Life is down there. Green land. Blue sky. Only there. And it's dying. And, oh, God, everything else is dark. Cold. Lifeless. Ev, we've got an impossible job to do. To try to give a world like that back to the Universe."

Silent, Ev processed what Mark had said. Earth slipped across the window. In the background, conversation built up again, with people pointing out favorite landmarks on the home planet to each other, voices low, as if in attendance at a wake. The televator inexorably rotated back toward the cold bright stars.

Ev said quietly, "The Genesis Foundation was prepared for what happened today. We're coming away with a tremendous quantity and variety of seeds and animal germ cells, and we'll—"

"And bug eggs," said a voice behind them, loud enough to be startling and even more so because it was a very familiar voice. "Ef'ry one forgets to mention much less thank God for the insects!"

Ev whirled toward the thin, blonde, middle-aged woman, with surprise written on his face.

She said, "I saw you perched here like a fine-feathered songbird, and I thought to myself, so! Such a surprise to see *him!*"

"The surprise is mutual, Professor van Leeuwen," said Ev. Mark did not recover as smoothly. "Anna!" he gasped. "You?"

She answered simply, "I have finally decided Samantha was not such a fool to go to the stars."

"Did you bring beetles and butterflies or did customs get them?" asked Mark.

"I did not decide to come just today, so already many of my species are up there. Good ones." She added, "I smuggled more butterfly eggs through customs just a little while ago. My precious butterfly eggs, disguised as makeup in my purse. To be exact, eyeshadow."

"You don't ever wear eyeshadow," said Mark.

"The customs agent knew that, I think. There he was, a nice-looking gentleman with hair gray around the edges, and I, a forty-eight-year-old lady with some gray hair too, am explaining to him my blue and mauve, some green, and bright yellow eyeshadow. He let me through and said not a word to those people in the suits which were the ones to watch out for. So they did not confiscate the eggs."

Anna saddened. "Oh, Mark. Remember the poor restoration prairie?" Tears leaked onto Anna's cheeks.

It was a memory etched with the acids of shame and anger. Mark put his arms around Anna's bony shoulders. In Mark's own eyes, tears blurred the Earth as it slid by behind Anna with all its burned forests, polluted seas, and blasted prairies. "We'll try it again," he managed to say.

"That we will," said Annetine. Sniffling, Anna turned to Ev. "Here are we two being so emotional, and not you, eh?"

"It won't hit me until we pass the orbit of Saturn," said Ev.

"So." Anna sat down. She fished a tissue out of her handbag and blew her nose. Mark and Ev sat on either armrest of the chair beside her. "Mark Willson, you I suspected maybe to meet on this trip. For months you have been asking for specimens for this and that flimsy reason. And looking every day gloomier than the day before. I have been thinking to myself, maybe Mark is going to the stars. But Dr. Evrett Reynolds, *you* surprise me!" She regarded Ev with blue eyes that were red-rimmed, yet piercing.

Mark said, "He surprised me, too. Not to mention Pennington Genetech."

"I would imagine, if today he quit from that high-paying job."

"I did more than just quit at Pennington." Ev indicated the mouse carrier. He grinned brilliantly. "Madam, I robbed the Pennington gene bank."

Annetine laughed, her characteristic, ringing laughter that could splinter the quiet in a small room. It sounded wonderful to Mark. "So how long have we until the docking?"

Ev gestured upward. "The ship is accelerating too. We're playing catch-up."

"We're already on our way?" Mark discovered that his battered stomach had one more flipflop left in it.

"Yes. Ship, televators and all, we're ascending, on the grounds that the authorities will throw everything they have at us if they realize how much genetic material we've stolen and how many good scientists are going with us."

Anna nodded.

Images appeared on the twelve walls of the middle of the deck. One flat video screen showed the Genesis Foundation's director, Kristeller, in an interview; on another screen appeared the President of the United States, in a news conference. There was sound, the words of the two men, but muted and from here audible only as a murmur. While the cold night of stars wheeled by the windows, Mark watched the other videos—pictures and diagrams of the ship. There was a depiction of the vaults of stasis, ready to receive and freeze thousands of colonists. Mark's eyes shied away to another screen, showing the greenhouse that would grow for centuries while people stayed in stasis. The greenhouse was crammed with young plants and seedling trees. Mark imagined the trees patiently growing for a century and more, a tangled green heart within the traveling starship.

The televator wheeled around. Below the wide window, Earth receded with the speed of ascent. Sunset, faded to maroon, rimmed the western edge of the planet. Closer and darker was the bulk of North America, detailed by the lights of the power grid. "We've got friends in low places," Ev announced. He pointed down. "Look at the western seaboard."

The power distribution grid was fading, like a sudden, visible cooling of the continent's fever. Umbra within penumbra, the center of the brownout was black. The blackout radiated from Star Field.

"The lights are going out down there. And so are the machines," said Ev. Elsewhere in the observation deck, puzzled voices were raised as others noticed the same thing.

Mark jumped up. "Are they shutting the Fountain down?"

"Just the opposite," Ev said firmly. "It was risky—interfering with the computer that controls the continental power grid. But a top executive in the power consortium was in on the plan. Look. You can see it happening. Power is being diverted to the Space Fountain, on an unprecedented scale. From which we get one hell of a boost."

"The executive," asked Anna, "has he gotten away with us? Do you know?"

"Yes, I do. No, he isn't coming. He's over the upper age limit. He stayed, and he'll probably be in prison for the rest of his life."

"Prison, for the crime of giving us a head start." Anna shook her head in dismay.

"And for destroying the Space Fountain." Anna gaped at Ev, who smiled thinly. "The energy surge will burn out the power plant and disperse the particle streams. So nobody can use the Fountain to come after us. And the North American launchers and spaceports that the authorities might have used against us are dropping out of service. The west coast Space Force bases are blacking out." Triumph edged Ev's voice. "Nothing on Earth can stop us now."

Mark sat down again on his arm of the chair. He felt dizzy.

On one video screen, the President of the United States appeared in a new mood. He was furious. He had been informed of the blackout. And he was telling the nation and world that the blackout had caused a high speed train accident in Nevada, and in California, a midair collision of two planes because the Air Net had been out of operation before emergency power came on. Five people had died. "How sad," Anna murmured, shaking her head. Ev just stared at the floor. The president's words were audible to the shocked, soundless audience on the observation deck. Anyone responsible for the blackout could be charged with terrorism. They would face the death penalty..

"That's bad." Ev still stared at the floor. "He wants sacrificial lambs."

The televator turned back toward the stars. This time, Mark recognized the thickest congregation of stars as the Milky Way. He had seen it from lands and seas on Earth, the glowing path across the sky; here it was vertical with respect to the view from the observation deck window.

Apart from the video screens, there were no lights on the observation deck. The Earth below had fallen under the pall of a night without the yellow glow of electricity, and Mark's eyes had adjusted to the darkened world. The Milky Way seemed like a solid mass of brilliance, a glittering column of bright stars and dust standing over the dark limb of Earth.

Ev said, "Mark, you're wrong."

"About something, or about everything?" Mark asked. He felt utterly drained.

"You said the stars are lifeless. They aren't. Cosmic genesis, remember? Big blue stars forge atoms—iron and oxygen and carbon. And when they turn into supernovas, they throw all the atoms of new stars and worlds and life out into space. So the Seven Sisters are our sisters. And organic molecules first formed in interstellar dust clouds. In the beginning, they rained on Earth, remember?"

"It was a hell of a long way from organic molecules to life on Earth," said Mark.

"At the start, Earth was a hard, hostile place. Life changed the water and the land, the air and the weather, slowly and surely, to make a place conducive to life. But, see, what we're doing is taking life back to the stars, where it came from. This time life will remake a hard world much more quickly." Ev smiled radiantly, not at Mark or Anna, but at the stars. "Life was exiled on Earth for four billion years. But it belongs to the stars."

Never had Mark known Ev to be much of a visionary. But what he had said sounded right. Mark nodded with a lump in his throat.

Anna laughed, though not as ringingly loudly as usual for her. Wonder softened her laughter. "That is good, Ev. Don't forget what you have told us here. When the going gets hard in the future, we will need to think that way about what we are doing."

Ev stood up and put his hand on the glass, leaning toward Earth. "I won't forget. Neither will somebody down there. When we get farther out, I'll be able to talk to Titan and Titan can send a confidential message back here, and I'll tell her."

Mark knew who Ev meant. "You can say I love her, too. And that I'll always remember her no matter what happens."

Anna reached up to squeeze Mark's shoulder. "My dear boy, don't worry. He's right. It's meant to be, that we will reach a good new world."

Mark thought about an unseen world, starstruck and barren. He felt his life point that way like a compass needle that stopped whirling and found its orientation. Mark looked up. *Primordium* still hung above their heads, and not so far above as before. Now it did not seem altogether like a threat to him. It was a promise, an immense and unbreakable one, the promise he was making to the world he loved: to implant its living soul, its ecosystem, in the soil of a new planet with his own hands.

One by one, the speeding televators caught up with the starship. Surface-to-orbit spacecraft, shuttles and spaceplanes, also came and made their rendezvous with the ship, bringing everyone else who had gotten away from Earth, with more of the stolen treasures of living things and seeds, genes and germ cells.

The Space Fountain poured out its final and fullest power, damaging the machinery irreparably. The Fountain pushed the starship to geosynchronous orbit and past that point, cast the starship on its course. The huge engines blazed to life. *Primordium* hurled itself into the desolation of interstellar space. And in front of the starship, the bright Milky Way stood out in the endless night, marking the direction of the journey that had just begun. ■

EDITOR'S NOTE: "A Pillar of Stars by Night" is a sequel to "Chrysalis," in our September 1992 issue.

IN TIMES TO COME

Next month leads off with a new serial by Charles Sheffield and Jerry Pournelle, with cover by Chris Moore. It's called *Higher Education*, and when you first meet their protagonist, you may think him a most unlikely candidate for higher education. But then, when they say "higher education," they mean it *much* more literally than most folks—and it's *exactly* what he needs (though he's at least as skeptical as you). It makes for a gripping story, and incidentally suggests a lesson or two that real-life educators here and now might do well to learn. . . .

The rest of the fiction line-up features a small constellation of *Analog* favorites, including Maya Kaathryn Bohnhoff (with a new tale of the irrepressible Rhys Llewellyn), James White, and David Brin. The science fact article is, at least potentially, an "audience participation" project. With public funding now virtually unavailable for the Search for Extraterrestrial Intelligence, Dr. H. Paul Shuch (Director of The SETI League) tells how a whole lot of small, private ventures can add up to something at least as valuable as one huge public one.

BIOLOG Jay Kay Klein

Although open to every human concern, science fiction has placed a heavier emphasis on engineering and physics than on the softer sciences and personal relationships as central to stories. Alexis Glynn Latner addresses these little explored subjects. She points out that SF is a literature of ideas, including the Big Ones: the nature of life and death, the origin and destiny of the world, what it means to be human. And even God.

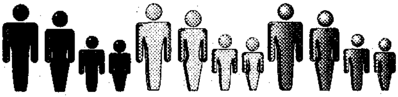
Alexis says she writes SF because that's just about the only gainful employment in which to make use of an M.A. in Systematic Theology. Harry Turtledove came to the same conclusion with a Ph.D. in Byzantine studies. She discovered SF at age eight. It was both fun and compelling, being all about what makes the Universe tick. There were wild, beautiful, and sometimes incredible speculations about prime motive forces.

Born in Pocatello, Idaho, Alexis was raised in Columbus, Georgia. As you'd expect of someone thrilled by SF, she enrolled in space physics and astronomy, at Rice University in Houston. But she was just too interested in *everything* for the single-minded concentration demanded of a scientist. After a year-and-a-half, she switched to linguistics, with a double major in German. Linguistics gives an insight into the inner workings of the mind. Not only do people think in words, but there are differences how particular languages guide thinking. Alexis went exploring how we conceptualize and communicate what makes the Universe work.

Alexis Glynn Latner

After the B.A., she took a couple of years off to think while working as a maintenance electrician. She hit the books again at the Graduate Theological Union in Berkeley, California. This was more of what makes the Universe tick, but now adding theology to the search. GTU's Center for Theology and the Natural Sciences was run by its founder Robert Russell, a Ph.D. physicist and ordained minister. His mission

(Continued on page 222)



POPULATION AND THE FUTURE: TWO VIEWS OF OUR PROSPECTS

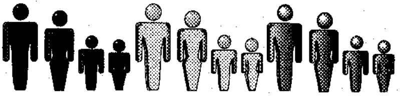
What are the long-term prospects for human survival? Educated guesses range from early extinction to long-term prosperity—but which, if any, can you believe?

It is obvious to anyone with any understanding of ecology that our fate depends very much on what happens to future population growth. Will it continue to increase? If so, will production of the things needed for survival and quality of life be able to keep pace? People tend to want easy answers, and find it distressing when even highly educated, thoughtful people disagree on the prognosis.

The problem is that there are so many variables interacting in complex ways, and neither the variables nor the interactions can be predicted with certainty. Many people simply believe what they want *to believe, applauding those who agree with them and dismissing those who don't.*

Analog *refuses to make it that easy. We could offer you an analysis by an optimistic scientist or a pessimistic one, and half the audience in either case might shrug it off as "the* Analog *party line." So we're offering instead a "debate," with* both *types of position represented. Thomas A. Easton tells you why he thinks the prospects look grim; Stephen L. Gillett tells why he thinks there may be ways out. Then they come together for a joint statement on where they agree and disagree.*

Both are scientists; both have done a lot of research and thinking; both say things worth thinking about. Read both, and draw your own conclusions.



Thomas A. Easton

TRAPPED BETWEEN DAMNATIONS: THE TRUE MEANING OF THE POPULATION CRISIS

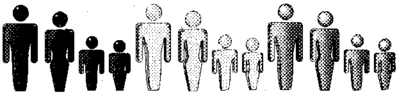
It is not news that the global population is rising and will continue to rise. The United Nations projects that it will reach 8.5 billion in 2025 and 10 billion in 2050. Some estimates put the world's population at 12.5 billion in 2050, when children born today will be merely middle-aged.

In 1950, when I was six years old, the world population was just over 2.5 billion. That is, by the time the century that began in 1950 ends, in the span of a single long lifetime, the world population will have increased four or five-fold. The result will be a vastly increased demand for water, food, metals, energy, wood, and all other resources. As a consequence, many expect that forests will be destroyed, species will vanish, and the air and water will grow foul.

The litany is familiar. It may even be accurate. But it is really beside the point. The true meaning of the population crisis is something else again—an ironic paradox that very few people appreciate. Not to put too fine a point on it, if we don't rein in our numbers, Mother Nature will, and the old dame is not known for her gentle hand.

That is, for the sake of our children, we *must* have fewer of them. Birth control is essential, and those who oppose it—from the Pope to the demonstrators outside the local abortion clinic—act in a way that is more "pro-death" than anything Hitler or Stalin ever did.

Such statements are provocative. To some they must be infuriating. But they are also inescapable if we look at the numbers that relate world population, grain production, and the amount of grain available per person per day, from 1950 to the present, and then attempt to project the numbers into the future. "Grain" includes wheat, rice, corn (maize), barley, oats, sorghum, millet, rye, and some other crops; because grain comprises the bulk of the human diet almost everywhere, its production is often



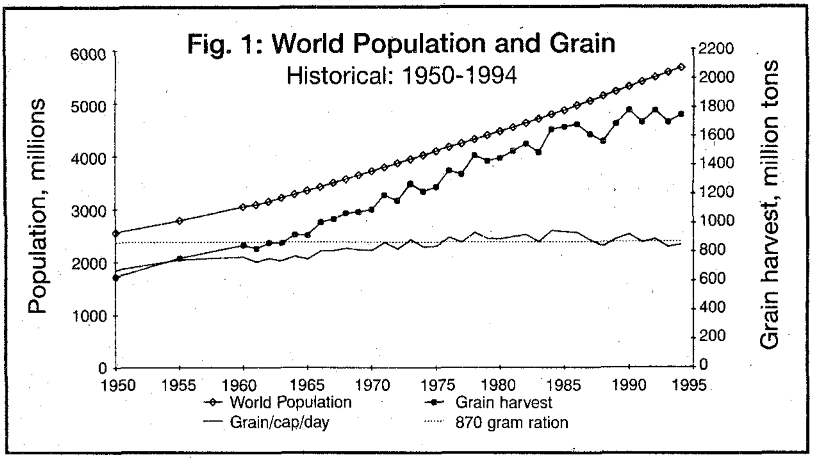


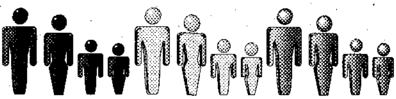
Fig. 1: World Population and Grain
Historical: 1950-1994

used as a stand-in for overall food production. The statistics for other foods show similar patterns; for some, such as seafood, the prognosis is worse.

As Figure 1 shows, the world's grain harvest increased tremendously between 1950 and 1994. It in fact increased more than enough to keep up with the growth in population, and the amount of grain available to the average resident of Earth each day grew from 680 grams (about 1.5 pounds, or 2,700 kilocalories) to 840 grams (about 1.8 pounds, or 3,400 kilocalories) today. Since about 40% of the grain harvest goes for animal feed—producing meat, eggs, milk, leather, wool, pets, animal labor, and even entertainment (e.g., horse races, zoos, and circuses)—the average human's share of the harvest now amounts to about 2,000 kilocalories of wheat flour, corn meal, corn on the cob, oatmeal, rice, barley, and so on. Other foods—meat, fish, dairy, fruits, and vegetables—supply the rest of the 2,000-3,000 kilocalories adults need each day to live healthy, vigorous lives.

Unfortunately, the grain harvest peaked in 1990, and the grain available per capita peaked in 1984, over a decade ago. Because the number of mouths to be fed has increased while the food supply has held relatively steady, the per capita grain ration has already slipped noticeably.

What does the future hold? It is very simple to calculate that if the world population does indeed reach 10 billion in 2050, and if the average citizen of the planet is to have as much grain available each day as he or she averaged from 1965 to 1994 (870 grams; 3,500 kilocalories), the world grain harvest will have to be about 3,200 million tons. Since in some parts of the world, many people are not adequately fed today, we should



increase the harvest even more. If standards of living are to rise in the nine-tenths of the world we call undeveloped or developing, we will need much, much more. Recent analyses note that increasing prosperity in China alone promises to demand by 2030 all the grain now exported by the United States (close to 100 million tons; half of world grain exports). Of course, demand will be increasing in other areas at the same time.

That is, in 2050 the world will have to produce nearly twice as much grain as it does now. In terms of percentage increase, we did even better between 1950 and 1994, but in terms of sheer tonnage the necessary increase in production is absolutely unprecedented.

It is also probably unachievable. Three chief limits on our ability to produce food are already apparent:

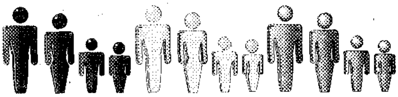
Most prime farmland is already being farmed. What remains is marginal land whose fertility is exhausted after very few years of use.

A third of the world's harvest comes from irrigated land. Irrigation water often comes from underground aquifers, many of which are already seriously depleted of their water and will not remain useful for more than a few more decades. At the same time, irrigation deposits mineral salts in soil; when the salt builds to high enough levels, crops do not grow. About 1.5 million hectares (3.7 million acres) are lost to salt build-up every year.

We are losing farmland. As population grows, we preempt it for housing, factories, roads, and other construction. In addition, erosion removes vast amounts of topsoil every year. "During the last 40 years," wrote David Pimentel and his coauthors in the February 24, 1995, *Science*, "nearly one-third of the world's arable land has been lost by erosion and continues to be lost at a rate of more than 10 million hectares per year." In the U.S. alone, erosion causes some $44 billion worth of damage per year. On a worldwide basis, it costs us each year the capacity to produce about 20 million tons of grain, a little more than 1% of the current world grain harvest.

These effects—and others, including the impacts of global warming—will of course be fought. We may even win the battle and keep the grain harvest on track toward the 3,200 million ton 2050 harvest that will mean people are no worse off than they were between 1965 and 1994 (see the top curve in Figure 2).

However, the harvest is already leveling off and there are reasons to think it may decline. Figure 2 shows three additional scenarios. In one, we hold the line and harvests do not decline below the 1994 level. In two, we manage a few record harvests before losses of fertile soil and irrigation water, as well as salinization, begin a steady decline. In the first of these pessimistic scenario, I assume we will be able to halt the decline after 20 years (2005-



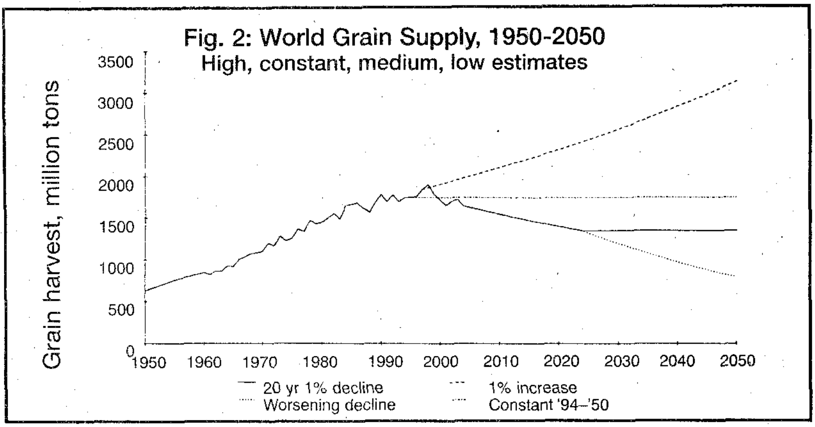


Fig. 2: World Grain Supply, 1950-2050
High, constant, medium, low estimates

2024), by which time the average per person grain ration will be half of what it is today. To be optimistic, I limit the decline to 1% per year; since this is *less than* the loss in productivity due to erosion alone, the actual decline could easily be worse, begin sooner, and last longer. In the second pessimistic scenario, I assume the 1% slide continues; please note that even this is *not* a worst-case scenario.

The exact effect of these scenarios on per-person food supply depends on population growth. The United Nations expects world population to hit 8.5 billion in 2025 and 10 billion in 2050. This is the "medium" estimate in Figure 3. My "high" estimate is 12.5

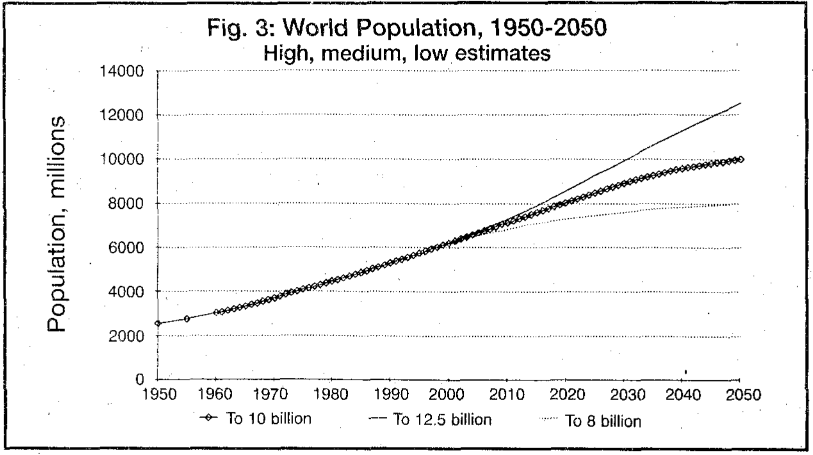
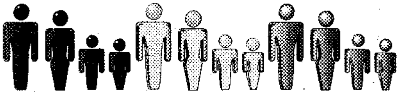


Fig. 3: World Population, 1950-2050
High, medium, low estimates



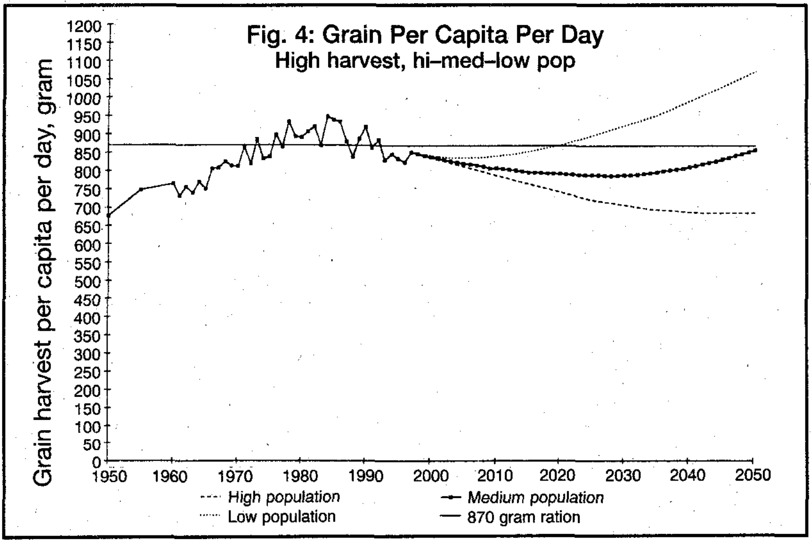


Fig. 4: Grain Per Capita Per Day
High harvest, hi–med–low pop

billion in 2050; it is worth noting that even this requires a decrease in the world's population growth rate; if growth were to continue at its present rate, we would top 14 billion by 2050. My "low" estimate is 8 billion in 2050; it comes from the UN population conference, held in Cairo, Egypt, in September 1994, which declared as a goal the stabilization of world population at a level of 7.8 billion by 2050; I assume the figure will surely inflate at least a little.

To see the range of effects on per-person food supply, consider two more graphs. Figure 4 shows how the highest harvest projection, constantly increasing to 3,200 million tons per year, feeds 2050 populations of 8, 10, and 12.5 billion. The smallest population is better off than we have ever been before, at least in terms of grain supply. The largest is about as well fed as we were in 1950. The middle population is as well fed as people averaged between 1964 and 1994.

However, the 2050 harvest may well fall short of 3,200 million tons, perhaps far short. Figure 5 shows how the *lowest* harvest—a continuing 1% decline after 2005, ending in 2050 at a mere 1,033 million tons, about the same as the 1967 harvest, when the population was 3.5 billion and the average daily ration was 810 grams—will affect us. This picture is quite bleak. Even the smallest population is only half as well fed as people were in 1950. A population of 10 billion people will "enjoy" a daily ration of 280 grams (1,100 kilocalories) of grain each, well below subsistence levels. The result will surely be

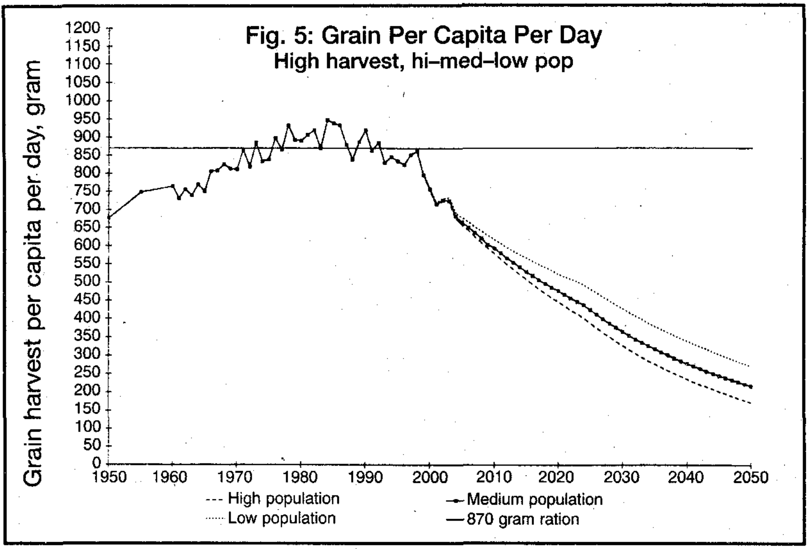


Fig. 5: Grain Per Capita Per Day

High harvest, hi–med–low pop

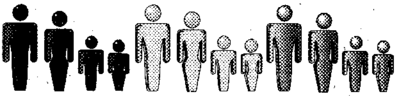
widespread starvation.

The two other harvest scenarios—constant and 20-year-slide-and-hold—offer intermediate conclusions, but in both cases even the smallest (8 billion) population winds up worse off than people were in 1950. Larger populations will suffer hunger, starvation, and—because malnutrition weakens defenses—disease. Demographic experts also expect mass migrations and war.

There may be ways to improve the food supply. In 1994, 38% of the world's grain harvest was used as feed for livestock. Perhaps half of this grain could be liberated for human consumption if people ate less meat. However, as standards of living increase, people want more animal products, not fewer. Further, eating less meat may well have no net effect at all. If fossil fuels become (as expected) less available, animal labor—and the need for feed grain—can be expected to become more widespread rather than less.

We would gain a great deal of lost ground if we returned more organic wastes to our fields instead of burying them in landfills or burning them in incinerators. Unfortunately, there already exist demonstration projects to turn such wastes into fuels and thus deprive the soil of essential organic material. Worse yet, the diversion of grain (maize) to fermentation of alcohol to be used as vehicle fuel (in gasohol) is already growing; it will increasingly deprive people of necessary food.

Genetic engineering will undoubtedly provide us with high-yield crops,



but even they will need soil. And despite all the high expectations of the fans of genetic engineering (including me), it is proving excruciatingly slow to make the necessary kind of progress. We cannot count on it.

Another improvement may lie in pest control. Estimates of the amount of the world's crops lost to mice, rats, insects, and fungi range up to 50%. If we could prevent all or some of the loss, we could clearly increase the food available for human consumption. Unfortunately, the use of pesticides leads

EIGHTEEN HUNDRED AND FROZE TO DEATH

"The year 1816 is remembered for its severity, characterized by frost every month of the year, and a snow-storm in June. Over a wide territory this condition prevailed, and the general description answers well for this locality.

"According to the best records, the first two months were mild; March, cold and stormy. In April, a new winter set in. Sleet and snow fell on half the days of May. In June there was frost nearly every night. The snow was five inches deep for several days in succession in the interior of New York, and from ten inches to three feet in Vermont and Maine. Mr. Jonathan Perkins of Hampton had a field of corn up high enough for the first hoeing; but not a blade was in sight above the snow, when he went out the morning after the storm. July was cold and frosty, ice forming as thick as window-panes in every one of the New England states. August was still worse, for ice formed nearly an inch in thickness and killed much vegetation in the United States and Europe.

"In the spring of 1817, corn that had been kept over from the crop of 1815, sold for from five to ten dollars a bushel, for seed. Mr. Elisha Johnson, being a large dealer in grain, had corn on hand, but he refused to take the enormous price, preferring to share the loss with the producers. This was characteristic of the man." (From J. Dow, *History of the Town of Hampton, NH, From Its Settlement in 1638, to the Autumn of 1892*, 1st ed. 1893, p. 324.)

The year 1816 was a year without crops in many areas. Its cause was the April 7, 1815, eruption of the Indonesian volcano Tambora, which killed some 12,000 people directly and 80,000 indirectly by destroying farmland and domestic animals in the vicinity. The blast's more distant effects followed from the huge amount of dust it added to the atmosphere. This dust cooled climate worldwide because it screened out sunlight.

Could such a disaster happen again? Of course. It could even be worse, for the Tambora eruption is by no means the biggest on record. And the effect of a year without a harvest on a seriously undernourished world—such as we can expect before 2050—would be utterly catastrophic.

inexorably to pesticide resistance and rapidly declining effectiveness of control efforts. Fungi—blights, rusts, and smuts—offer similar resistance to fungicides. And rodents are notorious for getting around the barriers we set in their way.

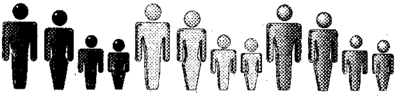
Some think that the crisis is so far off that we will have time to develop new technologies—perhaps based on nanoengineering—that will permit everyone to be fed.

However, many experts are less sanguine. K. O. Emery, writing in the March 1994 *Population and Environment,* tells us that, "the conclusion . . . is nearly completely avoided: that Malthus was correct." Thomas Malthus wrote in 1798 that because food supply cannot be increased as rapidly as population, the human population must inevitably outstrip its food supply and experience famine. Contrary to the conventional wisdom of the time, population growth was not necessarily a good thing. Indeed, it led inexorably to catastrophe.

Emery argues that we confront the Malthusian crisis *now*, today, in the lifetimes of ourselves and our children. If we are to survive, we must somehow increase the amount of food available. If we cannot do that, we must decrease the number of mouths that need filling. That is, we must reduce and *reverse* the population growth rate.

Projections of 2050 populations of 10 or 12.5 billion already assume a steady decline in the growth rate. If the world is to be as well fed in 2050 as it is today, and if we cannot keep the harvest growing, we must therefore improve even on these growth rate projections. If we do not, nature will do the job for us. We may even see a precipitous decline in human numbers, a Great Die-Off, that could reduce the world's population to well below current numbers. This is what happens when other organisms overrun the resources they need to survive. We are no different.

The effect will of course be worse in those countries that today have barely enough food for their people. We hardly dare to consider the consequences if a year's harvest is diminished by drought, flood, or other natural disaster (see sidebar), especially since world carryover grain stocks (the amount of grain in storage at the beginning of harvest, and hence available for famine relief if the crop fails) are now sufficient to feed the world for less than two months.



Preventing catastrophe will call for drastic measures. Some people think that trying to freeze population size by restricting couples to two children—zero population growth, or ZPG—is drastic enough. If it isn't, then certainly China's famous one couple-one child approach is, insofar as it lives up to its name (China's actual fertility rate is 2.2 children per woman, very close to ZPG; the country expects to grow by almost half by 2030.) However, neither can work in the short term. Thirty-two percent of the current world population is less than 15 years old, and only 6.5% is over 65. Those young reproducers will replicate their numbers long before the population can lose an equal number of oldsters, and their children can be expected to do the same. If the number of births per woman dropped today to the ZPG level, world population would still hit 8 billion before leveling off.

Some areas, such as North America and Europe, have their fertility rates at or below the replacement level. In fact, the U.S. Census Bureau estimates that net immigration now accounts for 28% of population growth in the United States and will account for *all* growth by the 2030s if present trends continue. In a June 1992 *Omni* interview, Garrett Hardin, Emeritus Professor of Human Ecology at the University of California in Santa Barbara noted that "The quickest, easiest, and most effective form of population control in the U.S., that I support wholeheartedly, is to end immigration."

Thinking more of the world's population problem than of the U.S.'s, Virginia Abernethy, Professor of Psychiatry and Anthropology at Vanderbilt University School of Medicine, goes even further. She argues persuasively that "traditional" societies long existed in balance with the ability of their environment to support them. The popularization of the idea that prosperity and economic development lead to small family size has produced since World War II a "flood of international aid and generous immigration policies," and "Ample evidence indicts the demographic transition model for fueling the 20th century overpopulation debacle." She argues that people reduce their fertility when times grow difficult, as in the former Soviet Union (Russia's birth rate reportedly dropped below the death rate in 1992), but as long as they see a promise of better times ahead—talk of sharing resources from the industrialized nations, open-door immigration policies, and the like—they will continue to be fertile and there will be a population explosion that defeats the effort to help.

Abernethy's startling conclusion is that reducing efforts to "help" will in the long run do more good than harm. The U.S. should therefore halt almost all immigration and large-scale foreign aid in order to help the rest of the world rediscover a sense of limits and thereby ease the worldwide population problem.

It follows that if nothing is done and population continues to grow until disaster strikes, that will teach the world the necessary sense of limits and the birth rate will drop. Unfortunately, while people are certainly capable of not having babies even without the Pill, condoms, and other modern birth control techniques, their methods can be as brutal as Mother Nature's. In China, many couples still use infanticide—especially of female infants—to keep within their one-child allotment.

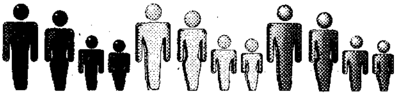
Some people refuse to admit that we face a problem. Writing in the May-June 1995 *Society,* Nicholas Eberstadt calls overpopulation a myth; the term has no defensible definition, he says, and indeed, some countries we call overpopulated are actually declining in population. He does not seem to see that when population overruns its resource base, decline is inevitable.

Others grant that there is a problem but think we will be able to cope. David Norse, a research associate for the Overseas Development Institute in London and a research fellow at the Environmental Change Unit at the University of Oxford, believes that it is possible to improve food production and distribution enough to support a population much larger than today's, although he recognizes that if population growth is not brought under control eventually, the best we can do is to stave off the day of reckoning. John Bongaarts, vice president and director of the research division of the Population Council in New York City, has a very similar view.

Charles Westoff says that our hope must lie in making family planning more widely available, creating a demand for small families, and encouraging later marriages. Such measures would undoubtedly help, but they will be difficult to implement rapidly enough to prevent disaster. Part of the difficulty lies in widespread resistance to family planning, which surfaced very clearly in the September 1994 UN population conference, which shied away from any mention of birth control (including abortion) in favor of vowing that the proper path is to educate women and give them control over their lives. It is true that educated, empowered women have fewer children, but education and empowerment take decades to show large effects. The process has to start when the women are children; it also takes time to train teachers.

If we truly wish to rein in population, we will have to find more rapid, more drastic measures. Indonesia uses powerful government pressure—more stringent than China's—to keep births down, an approach Eberstadt fears as "a foretaste of the future." Yet what other approaches might work quickly enough to prevent the Great Die-Off?

Mass murder? No one can seriously suggest that, but a genetically engi-



neered sterility plague might do the job, even if it does seem more at home in science fiction than in the real world. Perhaps we will agree on mandatory sterilization for all after their first child (India tried it on men in the 1970s), or for all refugee immigrants (who are likely to be fleeing regions where the problems of overpopulation are worst; there are currently some 10 million environmental refugees in the world, and another 17 million political, religious, and ethnic refugees; by 2050, according to Norman Myers, there may be 150 million environmental refugees alone, 1.5% of the world's population).

Unfortunately, many governments and individuals see every measure with much hope of actually working as tyrannical and/or inhumane, on a moral par with the Nazi Holocaust. It was largely objections from religious groups such as the Catholic Church and Moslem fundamentalists that kept the UN population conference from endorsing birth control. We can detect similar sentiments in the cries of hysterical activists that urging birth control on developing countries (where birth rates are highest) is a form of genocide, and even in American attitudes toward Chinese "fertility refugees" (the one couple-one child policy violates the purported basic human right to have all the children one wishes).

If we permit such attitudes to interfere with effective action, we can expect to encounter worse tyranny, worse inhumanity, and worse genocide from starvation, disease, and even war. And here is the crux. Inaction condemns us to the damnation of the biblical four horsemen. Yet action, effective action, means measures that offend against all that most of us think is kind, moral, ethical, decent, and right, measures that, if we adopt them, will leave us feeling that our souls are forever stained.

Perhaps more to the political point, if the U.S. were to follow Dr. Abernethy's prescription[1], it would become the target of vigorous attacks, both verbal and physical (probably including some from terrorists with suitcase nukes). Yet if we do nothing effective, we may prove responsible by our inaction for billions of deaths in a Great Die-Off. Our souls will be stained even blacker.

We are trapped between damnations, between the rock and the hard place, and there seems no way out of the trap. People are not likely to change their attitude until the Great Die-Off is in progress—this is an obvious corollary of Abernethy's point—and by then it will be too late. Nature will be solving the problem for us, and in a way far more brutal than anything we might do to ourselves in the

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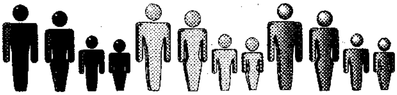
[1] It wouldn't be difficult. The U.S. has a strong isolationist tradition, and Congress is already trying to cut foreign aid in the name of deficit reduction, while border states such as California and Florida are crying for relief from immigrant hordes.



name of survival.

Or will it? Nature need not be quite that brutal. There is at least one gentler natural process developing today that may help if we do not fight it: a natural sterility plague—chlamydia. It is among the most widespread of sexually transmitted diseases, with an estimated 5 million new cases in the U.S. every year. It can produce pain and even death, but many of its victims are barely aware that they are infected until they try to have children. Then one of its main effects appears: in women, chlamydial infections often scar the uterine (Fallopian) tubes and block the movement of the egg to the uterus; the blockage may be complete or partial, preventing pregnancy entirely, making it less likely, or even forcing it to take the dangerous ectopic form (the fertilized egg implants in the tube or elsewhere in the abdomen). That is, chlamydia reduces fertility; this may be a tragedy for the individual, but it is a boon for an overpopulated world.

Unfortunately, few people are likely to stand by while chlamydia infringes their right to have babies. Yet the "right" to have babies is well worth questioning. The unrestricted exercise of that "right" is threatening humanity with suffering and death on a scale unprecedented in all of history. It therefore may be a wiser choice *not* to try to prevent or undo those side-effects of human behavior that diminish human fertility. In a very real sense, they may save us from ourselves.

If we do not restrict the "right" to have babies in some fashion, we can expect nature to remind us that we are just as much biological beings as pandas, whales, and elephants. We are no less subject to natural laws. We are not exempted from the consequences of our folly by the gods we profess to believe in. ■

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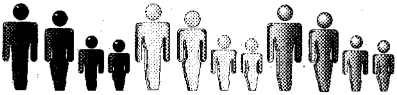

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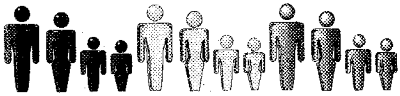


Stephen L. Gillett, Ph.D.

POPULATION, THE DEMOGRAPHIC TRANSITION, AND "BIOLOGICAL IMPERATIVES"

It is *not* in an organism's interest to have as many offspring as possible.

Sounds preposterous, right? Selfish genes, mechanical replicators, and all that . . . of *course* it's in an organism's interest to have as many offspring as possible!

Ah, but there's a very important unstated assumption in that statement, which I will now make explicit:

It's in an organism's interest to have as many offspring *survive* as possible.

And the difference is by no means semantic, because having as many offspring *survive* as possible generally means *not* having as many as possible.

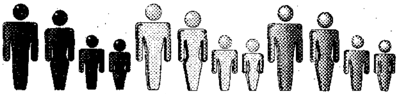
Of r *and* K

Ecologists call the naïve "breed-as-fast-as-you-can-and-damn-the-consequences" approach *r-strategy*[1], "*r*" for "rapid." Rabbits are *r*-strategists. So are doves. And cats. And salmon. And lemmings. As well as most of the "lower" life forms.

One risk of *r*-strategy is of becoming a resource for everyone else. All that effort put into cranking out offspring—only to see them snarfed up by a sea of predators. Look at salmon! Maybe one egg in a hundred thousand ever turns into a new breeding salmon. *R*-strategy also makes you extremely vulnerable to population booms and crashes.

Sure there's another way. It's *K-strategy*, named from fitting yourself into a population that's already at the limit, at that somewhat ill-defined number *K* that reflects the carrying capacity of the environment.

K-strategists are specialists. Because there are only so many slots available, you have to be very, very good at what you do to fit into one. Thus, *K* strategists typically have only a handful of offspring; better to put a lot of energy into preparing a few offspring and make sure of preserving your genes, than to have too many and lose all. For this reason they also show a tendency toward caring for their young, to better prepare them for that niche. They also typically—maybe



even intrinsically[2]—have high levels of direct intraspecific conflict.

Most higher animals are *K*-strategists (and some lower ones, including such unlikely critters as Nile crocodiles). Their populations are typically more stable, too, absent such major environmental perturbations as (say) a local volcanic eruption. Without such crises, *K* is not a variable!

Culture, Technology, and K

It should be obvious what sort of strategists human beings are. Even the most fecund human female has difficulty bearing more than a dozen or so offspring in her lifetime. Just among vertebrates, mice, doves, or salmon do vastly better! And our absurdly protracted infancy and childhood drives the point home even more.

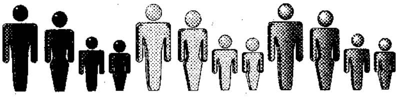
Thus, just from sheer biological considerations, the natural condition of human populations is *stable*. *K* is not a function of the rate of population increase. But this whole new human innovation of extragenetic information processing: technology, culture, and all that, raises some new issues. It turns out *K is* a strong function of culture and technology. Humans' profound innovation is to have kept upping *K*, and population then follows to reach a new steady state[3].

It's happened at least twice previously in human history, in the transitions from hunter-gatherers to peasant societies, and later from peasant to industrial societies[4]. Obviously these innovations haven't occurred uniformly, and a major part of the current population boom simply results from industrialization spreading across the planet.

Before we get into that, though, why has population "automatically" followed? Sure, as long as individuals are about evenly matched, the more numerous will automatically crowd out the fewer, if only over generations. But humans—or more specifically groups of humans—are *not* evenly matched, and it's certainly not obvious that the more numerous must prevail. Consider a horde of spear-wielding tribesmen against one soldier armed with a machine gun—not an unrealistic image for some of the encounters of late 19th-century Europeans.

This conundrum is even more striking in early agricultural civilizations. Although the conventional interpretation has had it that agriculture led to an improvement in nutrition, this is not supported by archeological evidence[5]. Thus any improvement must have been ephemeral indeed. In fact, agriculture was a nutritional disaster for the bulk of the people—the peasantry.

So why did it happen? A sheer increase in numbers doesn't help if it makes the individuals more vulnerable. A handful of starving peasants is not going to be able to put up much of a fight against (say) a well-fed barbarian raider[6].



The explanation is that the peasants don't do the fighting. The output of those underfed farmers feeds and equips one full-time professional warrior, who is not only able to fend off the barbarians, but is also in a position to keep the farmers working for him! Thus the enforced social stratification and division of labor of peasantry vs. warriors leads directly to the new formidability of their society as a whole.

This is another uniquely human innovation: individuals (in this case the warrior-aristocracy) now have a stake in the fecundity of *non*-relatives. Of course, any animal relies on the fecundity of its prey (whether animal or vegetable) to keep furnishing a resource it can exploit. What's biologically unprecedented is the reliance on the fecundity of *unrelated* individuals of the same species. Those other people have become the source of *labor*—the ultimate basis of traditional production. All traditional technologies, both those of commerce and war, are highly labor dependent, and *this* is what has given the society that can manage to support a higher population its edge.

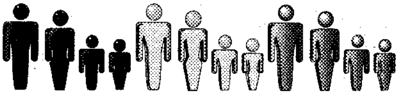
Thus, it also follows historically that when you *can* manage to support more people the society gets wealthier, because of the increase in the labor force (and the soldiering force, though that's not always mentioned). This is why economic growth has followed population increase. This is also why traditional economists view population growth as a Good Thing. (Of course, they oversimplify; the population growth doesn't "cause" economic growth, but an innovation allowing population growth becomes synergistic with further economic growth.)

We might wonder whether this correspondence of higher population with formidability will remain true. Consider, for example, that in the few centuries extending from about 1500 to 1900, a handful of Europeans managed to dominate the entire world—not merely the sparsely populated Americas and Australia, but the ancient and populous societies of Asia. Obviously, relative population sizes was not the controlling variable here[7].

Why Women and Children Aren't First

If human populations are naturally stable, what enforces that stability? Social constructs. Traditional cultures have been caught in a tight trade-off between having *enough* people (to till the soil, herd the stock, and fight off their neighbors—all labor-intensive activities), and having so many people they crowd the available resources too much. There's also the not-so-minor matter of *training* children, which is a costly and long-term process.

So you have to have, not just the right number of children, but also a robust arrangement for raising them for an extended period of time. And



the problem is compounded because (again up till very recently indeed) quite a number of those children are going to die before adulthood. Thus, for insurance you need to encourage fecundity, but only within a rigid social arrangement that ensures that the children can be reared and trained.

Such subtleties are not always appreciated. Some SF writers, mixing naïve biology with a sort of social Darwinism, have asserted "women and children first" as a fundamental law[8], and it's been suggested this is the "biological imperative" behind the current population explosion[9].

This is not true. For one thing, many hunter-gatherer and primitive agricultural societies had extremely strong taboos against adultery, which were enforced with savage penalties usually involving a painful and humiliating death: consider the ancient Jews, the Bronze-age peoples of northern Europe, or the Apaches. Modern observers tend not to get beyond a visceral horror at the savagery of the punishment to consider the extraordinarily large costs to the *society* inflicting it. Killing a fertile female at the height of her fertility, after the expense of raising her to adolescence, represents an enormous cost—which is compounded if her partner is also killed. (At the least, he's potentially a warrior!) Evidently the cost of unwanted children merited such extreme measures. The culture literally could not afford children outside the defined "raising system"—to the point they killed women who took such a risk.

Another example is the prevalence of infanticide in many traditional cultures. Indeed, traditional Inuit (Eskimo) culture practiced *female* infanticide[10]. Now, this was a highly sophisticated culture living as close to the edge of survival as humans ever have managed. If there weren't a pressing survival reason for killing girl babies, it wouldn't have happened. (The reason, probably, was that it took several male adults to support a single child. Again, if you have too many children, you risk losing all—the classic *K* conundrum. In a small, closely related group, moreover, there's no biological conflict of a childless adult working to support children not his own, as many of his genes are being carried by his collateral relations.)

Even in modern times, many cultures discriminate against girls, and female infanticide has not vanished by any means[11]. This stems from sheer biology: females bear the offspring. In turn, this biological fact is typically expressed by social and economic structures. Boys are assets, for example, not only because of their labor but because they remain part of the family and thus will be around to care for their aging parents. Girls, however, will leave, and furthermore commonly cost a dowry when they do. (From a biological standpoint, too, you can propagate your genes with sons as easily as daughters—more easily, in fact, because you don't incur the cost of child-raising.)

Many proto-urban or early urban cultures have also taken measures to limit children; e.g., infanticide in ancient China or Greece, or infant abandonment in medieval and early modern Europe. Economic considerations play a role here as well: because traditional farming was extremely labor-intensive, children were an asset on the farm. Children aren't nearly so valuable in an urban setting, though. Until the 20th century, cities were population *sinks*[12]. The people to replenish them came from rural areas.

Thus there's more to survival, for human populations as well as cultures, than just child*bearing!* In fact, children are cheap, biologically speaking. What is not cheap is raising them. In any society, the most valuable members are not "women and children" but its young adults, of either sex—traditionally, people from about 16 to maybe 30 or so. (These limits have been rising of late.) The culture has made its maximum investment in them, and now they need to produce. McNeill[13] points out that the Old World plagues were especially devastating when introduced to the Americas because they preferentially killed young adults. By contrast, Old World cultures, including the Europeans', had adapted to losing *children* to the diseases. Smallpox, for example, was an endemic childhood disease; and in the Middle Ages, small children weren't really considered part of the family till they'd survived it.

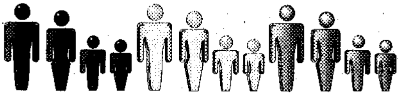
(Just to forestall any misunderstandings: I'm not being deliberately callous; I'm a parent, too. I'm simply reiterating cold historical fact.)

Simple Arithmetic—or Simplistic Arithmetic?

A great deal of the "population explosion" literature makes much of "exponential growth." Because exponentials are easy to work with, it's trivial to make entertaining but irrelevant projections of when (say) Earth's population will reach *n* (where *n* is large), or when the mass of the Earth has been entirely converted into people, or whatever[14]. These are typically followed by the ponderous observation that "exponential growth can't continue forever in a finite world." (Of course it can't! So what?)

In fact, real populations are describable by exponentials only over extremely short intervals. The famous S-curve, or *logistic curve,* in which an initially exponential growth tapers off to an asymptotic limit, is a much better model of the real world[15]. This in fact is where the parameters *r* and *K* come from. Such a curve is a very general result of a system in which further growth is inhibited by the increasing population density.

To be sure, it can also be simplistic. The approach to *K* is not always



smooth, and under some circumstances large and erratic oscillations of population around the *K* value may occur[16]. Such underdamping typically occurs if: (1) there are large time lags in response to the increasing density; or (2) the organism is highly specialized, so that it cannot shift to alternative resources if its food becomes exhausted. Examples of this latter situation include parasitic wasps on grain beetles in grain elevators, or lynxes vs. snowshoe rabbits. For human beings only case (1) is potentially a concern, both because humans have long generation times and also because of social inertia. However, since humans are also the most flexible creatures on the planet—in utter contrast to case (2)!—oscillations are certainly not a necessary consequence.

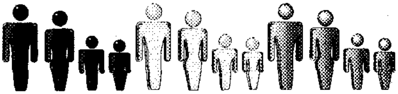
The Demographic Transition: The Approach to K

So the rapid growth in human numbers right now is an extremely temporary phenomenon[17]. Social structures adapted to a regime of high birth and death rates that were still tied to extremely labor-intensive peasant agriculture are lagging the new realities of low death rates, especially of children, and urbanization. We see this particularly because the locus of population increase is in the developing world. Birthrates *have* dropped in the industrialized world, in many cases to below the replacement level[18].

This decline is called the "demographic transition." It began in France in the 18th century and spread spottily over the rest of Europe through the next century or so, and thence to the rest of the industrialized (and industrializing) world[19]. The fundamental biological cause is the approach of *K*, but (as is usual with human beings) it's expressed by a stew of proximate social causes. One such, which has long been recognized, is affluence—although not "simply," because the benefits of affluence must be broadly distributed[20]. Another is social stability and low infant mortality; when children aren't assets, people won't have so many; but they nonetheless have to have a good chance of surviving. Yet another is women's status, as the total fertility rate (TFR) is well correlated with the education of women. They will have fewer children and take better care of them.

Broadly, such factors reflect the increasing specialization of the "niches" available, such that offspring require more and more preparation—and thus more and more economic outlay—to better their chances, not only of surviving but of prospering. Hence fewer offspring makes good biological sense. It's the best way to insure that genes are propagated—indeed, it's classic *K*-strategy.

For humans this strategy is further buttressed by economics. For one thing, as children become perceived as costs rather than assets people will



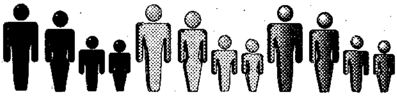
have fewer of them. Even when children remain assets, as when they are still their parents' source of support in old age, the greater investment required to train and educate those children mandates having fewer of them. In Thailand, for example, one place that's recently arrived at the demographic transition[21], interviews indicate that people are fully aware that two children with secondary school training are much more likely to prosper than six or eight with no schooling at all, and thus are much more likely to be able to support their parents in later years.

A demographic transition thus requires new economic and social structures to limit birthrates. It also requires *time,* as social attitudes take a few generations to shift. One interesting study[22] describes the gradual spread of birth-control practices among the landowner, merchant, and peasant classes in a town in (thoroughly Catholic) Sicily. It's particularly striking the degree to which a norm of few children became internalized among the "lower classes," so that a couple was willing to spend a lifetime practicing *coitus interruptus* to avoid pregnancies, because of the Church's proscriptions on "mechanical" birth control. The stress was made even worse, of course, by the strict taboos against sexual practices that could not result in pregnancy.

"Fare sacrifici" ("[One must] make sacrifices"), they said. Indeed! So even without cheap birth control techniques, social attitudes *will* change under the pressure of gritty economic realities. As Barnes noted[23], people aren't stupid—they are very good at perceiving their own interests. It is simply not true that people will just keep having children willy-nilly, despite the predictions of Malthus and such follow-ups as the "Marching Morons" scenario[24]. That makes no biological or economic sense. (Those who point to the cliché "welfare mamas"—assuming they actually exist—as a counterexample should consider two things: (1) if you're *paying* people to have babies, you can hardly be surprised when they do; but (2) does anyone really think they're doing "better" by breeding indiscriminately? It's not the number of offspring but their *survival* that counts.)

"Overshoot" and K

The more sophisticated gloom 'n' doomers realize that the complexity of the real world is not described by exponentials, however impressive and mathematically tractable they may be. They claim, however, that the final population level will be unsustainable because the resources to support so many people don't exist. Such "overshoot"[25], after consumption of the Earth's "natural capital," will then inevitably be followed by a catastrophic population crash. One author has even called modern *H. sapiens* a "detritovore"[26], in analogy to



scavengers feeding on detritus. On finding a rich deposit, such species can have a spectacular population boom, followed by an equally spectacular crash as the resource is exhausted. The implication is that not only can't we achieve US-level affluence for the entire world, but even our own affluence is doomed.

Many in this school of thought also note that the industrialized countries, with their low, even sub-replacement birth rates, have a disproportionate impact due to their consumption of resources and output of pollution, so they're still "overpopulated"[27].

All such scenarios, however, confound the limitations of current engineering practice with laws of nature. (There's a perverse element of wishful thinking involved here, too[28].) Present technologies are extremely primitive, as should be obvious by comparison with the capabilities of biological systems (something biologists, of all people, should realize!). As we move away from these technologies and ultimately toward nanotechnologies[29], low-impact affluence will become possible, not just for the industrialized countries, but for all. The impact of technology on the bio-sphere can become arbitrarily low as technology becomes arbitrarily sophisticated. Indeed, one could use level of impact as a criterion of the sophistication of a technology. (Elsewhere, Erhlich and his coworkers seem, in part, to recognize such considerations[30].)

This also puts to rest another strawman scenario, the idea that to make the developing world "wealthy" would involve building them enough roads/cars/discos/suburbs/etc. *now*. This is extraordinarily naïve. Even the First World will have to change to new technologies as the oil runs out. There is absolutely no point in implementing any more of the old technologies now than we need to. Insofar as possible, it makes far more sense to move toward the technologies of the future.

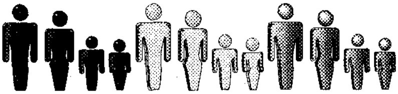
Desperately Seeking K

"The problem is not population growth per se, [but] when the rate of population growth exceeds the rate at which technology and social change can compensate."

—Bruce Wilcox[31]

To take the other tack; if a demographic transition will happen eventually in the Third World, why then should we even worry? In particular, why bother to encourage an early demographic transition, of compressing into a single generation what took Europe over a century?

Several reasons. One is that the technologies that will achieve affluence for the teeming billions aren't ready yet—and buying some time is vital. Second, raw labor is not nearly so valuable any more, as more and more of the grunt work of primary production is taken up by machines. So, the paradigm of "more people,



more labor," which has previously rewarded population growth, is obsolete. In modern "cyberwar," the unskilled masses aren't even useful as cannon fodder any more—look at the Gulf War.

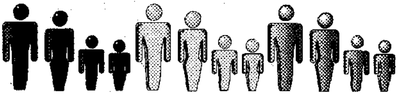
Because of this Ehrlich is certainly correct, and economist Julian Simon is wrong, in that people, *per se,* are *not* the "ultimate resource"[32]. Ehrlich is also wrong, though. In the information economy, what *is* the ultimate resource is not so much the "inherited capital of the Earth," as he claims, but the education and skills of those people. Those are expensive and time-consuming to acquire, and becoming more so, as we've seen. (To be sure, the stored knowledge and experience of humanity—"information capital," if you will, is also vital.)

The last reason is esthetic and ethical. More things are possible in a world less utterly dominated by humans; for one thing, backcountry permits will be easier to get! More nonhuman life forms will survive, too; not only is this an ethical consideration, there's a strong element of self-interest, too, from the knowledge that can be gained from these organisms and the communities they live in.

Since a demographic transition involves profound *social* changes, education—especially of women—is critical[33], although raising living standards and furnishing contraceptives are also important. Of course, educating women puts what David Brin calls the "macho" cultures in a bind: they can't ignore education, because the outlets for unskilled or semiskilled labor are dwindling so rapidly, and a country that expects to survive needs a highly educated work force. Yet when they *do* educate people (not just women), their archaic social structures become strained.

The developing nations *are* dominated by young people, true. This is commonly regarded as a demographic disaster in the making, because the population is dominated by the highly fertile, who can continue childbearing for years. But there's also a bright spot: young populations can be a lot more flexible, and cultural attitudes can change a lot more quickly, because domination by the young can attenuate the cultural continuity between generations, particularly in an era of cheap mass communication.

I will make a note on how *not* to do it. A "triage" approach, in which the First World simply writes off large parts of the developing world, will backfire spectacularly. Even worse would be what might be euphemistically described as "active measures." Hardin[34] describes the necessity of shooting most of a starving deer herd on an overcrowded island, with at least the implication that something similar may be required for people. Aside from the appalling ethical problem here—who decides who should be "culled"?—he seems to forget that deer can't shoot back but people can!



Even with the "best" intentions, too, the staggering potential for abuse in any sort of "culling" program should require its dismissal *a priori*. Consider how the 20th century has largely been characterized by mass murder in support of "necessary" political agendas[35].

Even worse: if you wanted to encourage a bunker mentality of "us agin them," you could hardly go about it better. And that is likely to make for an unpleasant world indeed. *Lots* of nukes are out there, with the collapse of the Soviet Union—and anyway, as Heinlein noted, you can't classify the laws of physics. Check out Martin van Creveld's *The Transformation of War*[36] for the flavor of the international politics of the 21st century. His predictions of domestic terrorism in particular seem eerily prophetic, as I write this a few weeks after a huge bomb has gone off in Oklahoma City, evidently the work of homegrown terrorists. It's going to be bad enough as it is. Wrongheaded "eco-isolationist" policies, with their effective encouragement of terrorism, would make it far worse.

No, of course terrorists won't be able to destroy the US or even the rest of the First World. But they could make it uncomfortable. In fact, I think the severe curtailment of civil liberties that is likely to result under such a scenario would do more long-term damage than any number of terrorist bombs.

Last and most ironically, "culling" is unlikely to have any long-term effect on population. Mass mortality is *not* a way to encourage lowering the fertility rate. Quite the reverse, in fact; it's the historical encouragement for high fertility; "compensatory mortality," in the ecologists' phrase. (Ecologists like Ehrlich, who warned that pesticides would have little long-term effect against insect pests, should realize this!)

"People as the Problem"

"Development is something that happens because of the poor, not in spite of the poor."

—Idriss Jazairy[37]

"We" have to "solve" the population "problem." "Governments" must "provide" services "for" more and more new people. Etc.

You hear phrases like this a lot, and I suggest this is a completely counterproductive approach. Despite confident predictions and 50 years of AI research, we still have no clue as to how to make a system with even rudimentary intelligence, much less the flexibility, autonomy, and power of a human. Why on Earth, then, are these autonomous, self-programming entities not viewed as part of the *solution?* As the economists point out, every one of those new mouths to feed comes with a pair of hands attached—and, it might be added, a brain as well.

Many of the interim things that

could be done in the developing world are labor-intensive. One example is intensive agriculture, in which much labor goes to maintaining the land, such as in the Machakos district of Kenya[38]. Yet, alas, in much of Africa, heartbreakingly perverse *political* disincentives to increasing small farmers' food production are the rule[39]. The vast conurbations growing in the Third World, with all their vast problems, also contain a vast labor pool that could potentially address at least some of their problems. Consider road building, garbage collection. . . .

I've implied it above, but I'll say it again: population is a much a *social* issue as "economic," "ecological," or "technological." And a focus on helping people help themselves is much more likely to be effective than "solving" the "problem" from on high.

The Limits to Biology

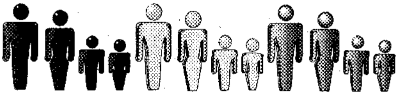
The alert reader will have noticed a problem in talking about *K* strategy. Why should birthrates drop *below* replacement? That makes no biological sense! Indeed, how can we talk of "forcing" a demographic transition, of reaching a "lower" *K? K* is one number, right?

In theory, sure. But in fact it's time to acknowledge: humans are not driven only by biology. Sure, human nature is not infinitely pliable; the ignominious collapse of state-sponsored socialism demonstrates that. Nonetheless, cultural conditioning does have a profound effect.

Amusingly, it's quite common for people to make what they think are "biological" arguments that merely demonstrate the depth of their cultural conditioning. Here's an example from Heinlein's essay "The Pragmatics of Patriotism"[40], in which he described a young husband and a tramp who both were killed by a train while trying to free the wife's foot from a switch. Heinlein tried to make this a parable of the "biological" truism of "Women and children first"—and it's nothing of the sort. Obviously no biological imperative holds the tramp there—getting himself killed in a vain attempt to save a stranger will not help his genes propagate. Quite the reverse, in fact!

But the exact same analysis is true of the husband: rather than kill himself, he too should find a new mate so his genes can propogate. This is the *real* biological imperative, and Dawkins[41] gives a number of natural examples. The doe, losing the battle to protect her fawn, will suddenly save herself and leave the fawn to its fate. There is absolutely no point, biologically, in getting yourself killed in a probably vain attempt to save an offspring. If you stay alive, you may have a chance for more offspring, so the thing to do is cut your losses.

But this analysis violates our most profound cultural conditioning—which is exactly my point. We *are*, after



all, capable of carrying out programs—even unto death—that nothing whatsoever in our biological makeup has prepared us for.

Toward the Hopeful Future

Overshoot remains possible; certainly the perversity of human history suggests that it could happen. But equally certainly, it is not inevitable.

Humans and their societies have long since reached a level of complexity in which the interactions are so multitudinous, and so non-linear, that the system(s) can exhibit unexpected behavior indeed. Because humans are a young species, moreover, these interactions have hardly settled down. Any student of human evolution can rattle off many more such epiphenomena resulting from an unexpected confluence of factors: e.g., music as inspired by the mother's heartbeat; overhand throwing as leading to planning, through the necessity of "preprogramming" ballistic movements, which in turn makes such skills as piano playing possible; and so on and so on.

And of course, changes aren't slowing down. Biological evolution has become essentially irrelevant to human beings; it works on timescales of tens to hundreds of thousands of years, whereas human societies are overturning themselves within decades. But of course this is old hat to *Analog* readers, who are familiar with Vernor Vinge's idea of the Singularity.

The point of all this is that birthrates might go very low indeed. Perhaps humans beings will become too interested in other things to bother with breeding—children are *work*, after all. "If you give people access to contraceptives and abortion they practically stop having children"[42].

NOTES AND REFERENCES

1. Any ecology text will discuss *r* and *K* strategy—in more depth than you probably wanted! The one we use at the University of Nevada, Reno is Charles R. Krebs, *Ecology,* 4th ed., 1994.

2. *Ibid.,* p. 345.

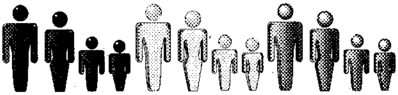
3. Paul V. Colinvaux, *The Fates of Nations,* 1980. Some of his inferences seem a bit extreme; e.g., given the labor-intensive agriculture of Classical times, it's hard to see how the Roman countryside could have become depopulated while the cities burgeoned.

4. Robert W. Kates, "Sustaining Life on Earth," *Scientific American,* October 1994, has a nice graph.

5. Diamond, Jared, *The Third Chimpanzee,* Harper Perennial, 1992, p. 180 ff.

6. Diamond, p. 190. Although he misstated this point, this remains an excellent book.

7. Military technology is the obvious factor; see (e.g.) William H. McNeill, *The Rise of the West* (University of Chicago, 1963) and *The Pursuit of Power* (University of Chicago, 1982); J.H. Parry, *The Establishment of the European Hegemony, 1415-1715,*



3rd. edition, Harper & Row, 1966.

8. Robert A. Heinlein, *The Notebooks of Lazarus Long,* reprinted in *New Destinies, VI,* 1988, p. 64.

9. L. Sprague de Camp, "Goat Island," *Analog,* April 94.

10. *Science News*, p. 358, 26 November 1994.

11. e.g., George Moffett, *Critical Masses* (Viking Peguin, 1994), p. 217-218. This is a recent, thoroughly referenced, and balanced account; if you read just one book on population issues, this should be it.

12. e.g., John Barnes, "How to Build a Future," *Analog,* March 1990; William H. McNeill, *Plagues and Peoples,* Anchor Press, 1976, p. 62 ff.

13. *Plagues and Peoples,* Ch. 5; cf. also pp. 130-131, 180.

14. e.g., Donald R. Kingsbury, Letter, *Analog,* November 1994.

15. e.g., Krebs, *op. cit.,* pp. 204 ff.

16. e.g., Krebs, *op. cit.,* p. 198-203; 285-286; Ch. 16.

17. e.g., Moffett, *op. cit.,* and references therein.

18. TFR (total fertility rate) in Western Europe is around 1.3-1.5; Paul R. Ehrlich and Anne H. Ehrlich, *The Population Explosion (TPE;* Simon & Schuster, 1990), p. 193-194; Catholic Italy has one of the lowest, at 1.3! (p. 196). The US "baby boom" ended abruptly by the early '70s, during which the birthrate dropped to below replacement level (Anne H. Ehrlich & Paul R. Ehrlich, *Earth* (F. Watts, 1987), p. 205; currently it's about 1.9; *TPE,* p. 194). It is also probably not accidental that the collapse of the US birthrate around 1970 is when the modern women's movement became vocal. The US population is still growing only because of demographic momentum (as well as immigration, to the tune of perhaps 25%; *TPE* p. 274, note 23).

19. John R. Gillis, Louise V. Tilly, and David Levine, eds., *The European Experience of Declining Fertility, 1850-1970*, Blackwell, Cambridge, MA, 1992; this is a follow-up to a monumental study by Ansley J. Coale and his students: A.J. Coale and S.C. Watkins, eds., *The Decline of Fertility in Europe,* Princeton University Press, 1986 (summary volume). Even the newly industrializing countries in Asia are undergoing a demographic transition (e.g., Taiwan, *The Economist,* June 5th-11th, 1993, p. 41).

20. Moffett *(op. cit.)* extensively discusses all these points.

21. Moffett, *op. cit.,* pp. 147 ff.

22. Schneider and Schneider in Gillis, Tilly, & Levine, *op. cit.*

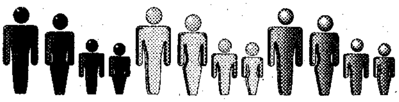
23. Barnes, *op. cit.*

24. Cyril M. Kornbluth, "The Marching Morons," reprinted in Frederick Pohl, ed., *Nightmare Age,* 1970.

25. This was a major theme of *Limits to Growth* (1972) and pervades the Ehrlichs' writings, for example.

26. William R. Cotton, *Overshoot,* University of Illinois Press, 1980.

27. The Ehrlichs *[ops. cit.]* also emphasize this.



28. K. Eric Drexler, *Engines of Creation,* Anchor Doubleday, 1986, p. 166-167.

29. A "nanomechanical" approach is promoted by Eric Drexler (*op. cit.;* also *Nanosystems,* Wiley Interscience, 1992), but an alternative approach to nanotechnology is given by Allen J. Bard, *Integrated Chemical Systems: A Chemical Approach to Nanotechnology* (Wiley Interscience, 1994). I have previously presented nearer term approaches involving "lower grade" nanotechnology (Gillett, "The Environment, Technology Drivers, and Nanotechnology," *Analog,* pp. 54-69, November 1994).

30. Paul R. Ehrlich and Anne H. Ehrlich, *Healing the Planet,* Addison-Wesley, 1991.

31. Quoted in Moffett, *op. cit.,* p. 16. Wilcox is a biologist at the Institute for Sustainable Development in Menlo Park, CA.

32. Ehrlich, *op. cit.;* Julian Simon, *The Ultimate Resource,* Princeton Univ. Press, 1981.

33. Moffett, *op. cit.,* Ch. 5.

34. Garrett Hardin, *Living Within Limits,* Oxford University Press, 1993, p. 210.

35. Ivanov's expositions to Rubashov in Arthur Koestler's *Darkness at Noon* (Macmillan, 1941) remains as chilling a justification of "active social engineering" as has been presented.

36. Martin van Creveld, *The Transformation of War,* Maxwell-Macmillan International, 1991.

37. Quoted in Moffett, *op. cit.,* p. 92. Jazairy is a former president of the International Fund for Agricultural Development, a UN agency.

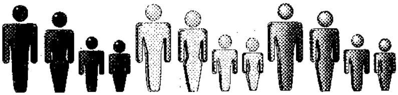
38. *Ibid.,* p. 61 ff.

39. *Ibid.,* Ch. 2 and 3.

40. Robert A. Heinlein, "The Pragmatics of Patriotism," Guest Editorial, *Analog,* January 1974. Reprinted in *Expanded Universe,* Ace Books, 1980, and no doubt elsewhere as well. Interestingly, in the letters published in response to Heinlein's piece (*Analog,* May 1974), no one commented directly on these flaws in his analysis, although a couple of readers skated near them.

41. Richard Dawkins, *The Selfish Gene,* 1977.

42. Malcolm Potts, University of California at Berkeley; quoted in Moffett, *op. cit.,* p. 296. ■



Stephen L. Gillett, Ph.D.
& Thomas A. Easton

CONCLUDING STATEMENTS

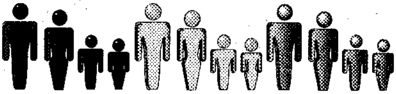
We—Steve Gillett and Tom Easton—sent each other our articles, criticized them, and argued at some length via e-mail. Finally, we decided this summary statement, in which we emphasize both our agreement and our disagreement, was a better way to conclude the "debate" than a pair of attempted rebuttals.

We each see a problem. Tom sees it in terms of insupportable human numbers that must be reduced by human effort or will be reduced by the forces of nature (meaning famine, plague, and war).

Steve is more optimistic. He thinks that humanity will manage to control its fertility, much as it and other species have done in the past, so that its numbers match the available resources. Further, new technologies such as he described in a previous article (*Analog,* November 1994) will meet the demand for food, water, and other resources. Indeed, they *must* meet those demands, for even in the First World we cannot rely on present petroleum-based technologies for more than another generation or so.

In response, Tom says, "I'll grant you that living things can and have adjusted their fertility to match available resources. However, the adjustment is often catastrophic, happening only after the resources prove inadequate. And I'm afraid we're heading for such a catastrophe, for there is developing a huge discrepancy between one particular resource—food—and the human population, and it is developing more rapidly than any historical precedent.

"I'll also grant you that new technologies would help and that we can—as you have—identify helpful directions in which to look. But I don't think we can develop the necessary food-production technologies in the time available. Part of the reason is that drastic change in society is very difficult to achieve and takes decades—and decades is all we have. A more significant reason is that increasing population puts a huge demand on money and resources for basic maintenance (minimal food and water supplies, sewers, health services, etc.), to the point where new technologies are out of reach. There is also a human tendency not to start bailing until our asses are getting wet, and most people do



not realize there is even a hole in the boat. Some even seem to think the boat is sitting on dry land.

"I hope I'm wrong," says Tom. "I hope you're right. But I really don't expect that we will be able to prevent the Great Die-Off. Mother Nature will rein us in. And then, fewer but wiser (I hope), we will go on."

Steve responds, "Sure, it could happen, but it certainly isn't inevitable. And I worry about self-fulfilling prophecies. Since Malthus's original work, we've heard many prophecies of eco-doom, none of which have come to pass. Now, one could argue (and people do) that although the timescales were off, those prophecies were basically correct; but at some point this begins to seem like the cults who keep rescheduling Judgment Day when it doesn't happen at the appointed time. (They also risk sounding like the boy who cried wolf; if there *is* eventually a crisis, the warnings are not likely to be taken seriously.)

"The cavalier disengagement from the rest of the world that Abernethy *et al.* preach might easily lead to such a self-fulfilling prophecy. If we *had* (say) written off most of the developing world because of 'inevitable' famines, as Ehrlich suggested back in the late '60s, we would have killed millions. But in fact, Ehrlich was simply wrong.

"Disengagement is also unrealistic because of the First World's present technology, which requires a river of resources—in particular oil!—flowing in from the Third World. So we'll say, 'We need your resources, but don't expect any help in return'? The staggering political naïveté of such an approach doesn't need to be belabored.

"And considering 'present' technology leads to another point: The oil won't last forever. In any case the First World will soon have to use its wealth and expertise to develop new technologies, technologies that moreover will make an affluent lifestyle possible for the entire Earth. Thus, it's not as though some sugar-daddy has to invest a few gigabucks just to save the Third World.

"Such a 'technological fix' is not a vague magic wand, either. We *know,* at least specifically enough to set up reasonable developmental strategies, what those technologies are. They will probably involve nanostructured materials, things like semi-permeable membranes, catalysis surfaces, photosynthetic/photovoltaic films, and I expect them to progress rapidly and make a lot of people rich in the next couple of decades (see my November 1994 article).

"Finally, I re-emphasize that population is not just, or even mostly, a technological problem, but a social problem. Tom and I have both noted the social nature of the demographic transition, but there's more to it than that, especially in the near term.

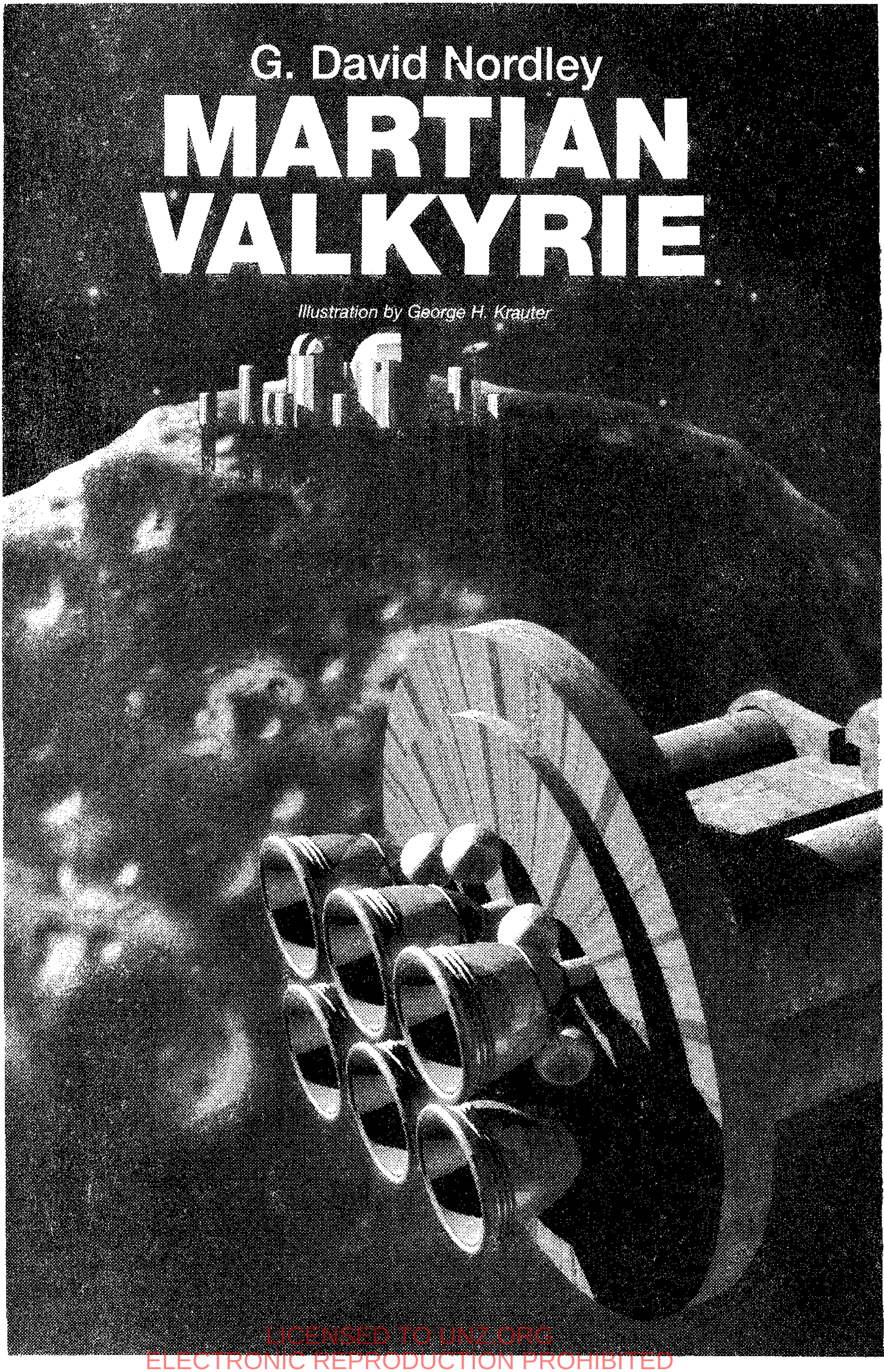
"For example, I was struck by a note that Africa has 20% of the world's arable land but only 9% of its people, such that it has 1/3 fewer people per acre than the developing world as a whole [Moffett, p. 88]. This is poor, basket-case Africa, where living standards (unlike virtually anywhere else in the world) have *dropped* in the last two decades!

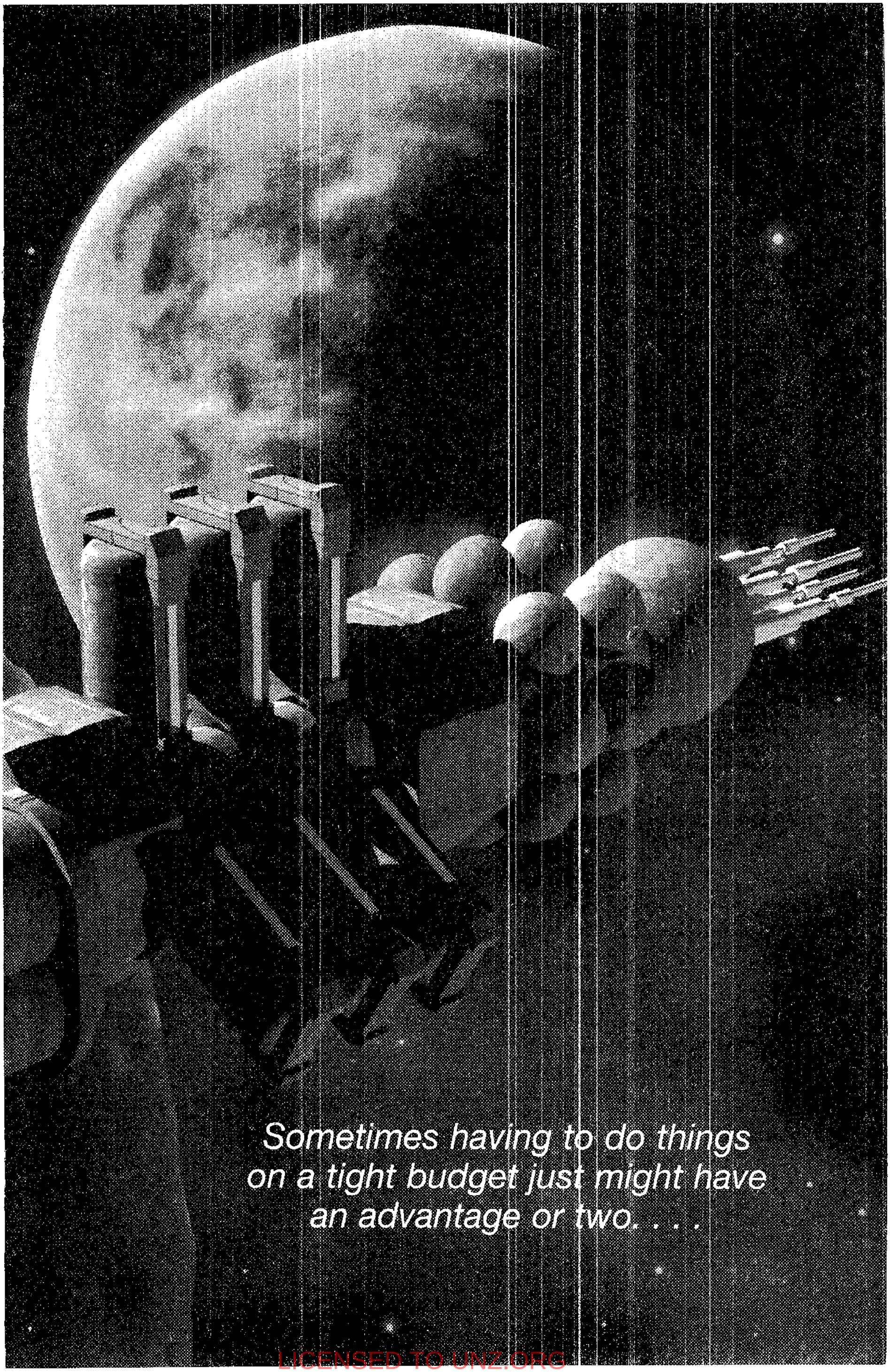
"Obviously the problem here does not lie in the physical resources available. It lies in social structures that neglect infrastructure and destroy incentive, among other things. And here is another reason Abernethy's proposals are so off the mark. Although much developmental aid has clearly been misdirected, it seems that encouraging such governments to (say) set up free markets for agricultural products and build up a basic transportation infrastructure would be a cheap, easy way to promote sustainable development. True, such projects are not nearly so glamorous as (say) a single large dam, but they're likely to be much more important." ■

G. David Nordley

MARTIAN VALKYRIE

Illustration by George H. Krauter





Sometimes having to do things on a tight budget just might have an advantage or two. . . .

I, Enrico Lopez, am the first man to set foot on Mars and come back alive. But there are moments when I feel a heroic death, like that of Robert Falcon Scott, would have suited me far better. Better than what I must live with, and what I must live without.

Back in Bergen, old man Halvorsen must still be laughing. Yes, he is still alive and intends to live forever. Any day now, the genetic engineers have been saying. Good for him. He does not dare die, I think, for where he is going they will not be so gentle.

Let him laugh, part of me says. Despite our problems, we got much more scientific data, core samples, measurements, and everything. Our rovers roved, our balloons floated, and our scientists have enough data for a million graduate theses. So, in the long view of things, I suppose it matters not one bit who was first on Mars or how we got back.

Except to me, and to history.

Four days out from Earth on our very carefully planned trajectory, things had settled into a nominal routine. The United Nations's official expedition was a four-ship orbital armada, with forty carefully chosen and politically representative scientists and astronauts and the latest hardware, including nuclear thermal rockets and power-assisted hard suits. With a trillion dollars spent in planning, programming, research and development before the first cargo ships left low Earth orbit, we had all the requirements covered. As its commander, I would be on the first shuttle down and first on the surface. I had my speech memorized.

I remember the moment everything changed with vivid clarity. I was in my double-sized cabin on our flagship, the *Zhang-Diaz,* and had just strapped myself into my bunk and ordered the lights down. I had just started to dream about my wife, Linda, and other women I have known, when two loud tones signaled an event important enough to perturb my sleep schedule. I mention it because, even at the expense of my dignity, I cannot resist this irony. For those who believe in signs, there it is.

A voice followed the chimes. "Enrico, this is Mustaffa." Ahmed Mustaffa was the spacecraft's master and my second for the expedition.

"I am awake. What is it?"

"We just downloaded a message from Thor Halvorsen. That Norwegian lunar expedition—it's departed and it doesn't look like it's going to the Moon."

"Where else would it go?" I asked. The Norwegians' tiny, stubbornly independent space exploration effort had just assembled two lunar spacecraft in low orbit. Had they had another accident? Two years ago, they had lost the supplies for a Norwegian lunar base camp when their cargo ships had failed to do the lunar orbit insertion burn. Cut-rate space programs are the most expensive kind, I told myself. Would we have to rescue them and sacrifice some or all of our own mission? "What is the message, Mustaffa?"

"All the message said was, 'Norway mission headed toward Mars—Halvorsen.' But there's a press release appended. The file's under 'Halvorsen.' "

I suddenly felt cold. It was no accident. Had it been anyone else, I would have taken this as a historical joke, but, a generation ago, Halvorsen had found the buried glacier in the rim of Amundsen Crater near the lunar south pole—with a tenth the usual budget. He took his nation's history of exploration very seriously, and he had all the daring and competence of his forbears.

My cabin featured a small desk next to my bunk, and over the desk was my vid, a mosaic of sixteen flat high-resolution panels joined seamlessly in a commander-sized interface display. A perk of office, but I had to get out of bed to look at it. I resealed and adjusted my tight suit, undid the velcro restraints, and swung myself out of the bunk so I floated in front of it. The sterile circulating air chilled me—our vents did their job so efficiently that they took even the smell of my body away before it could reach my nose.

"Display the Halvorsen file," I said. Text and a diagram filled the vid.

I stared at the report in disbelief. They had launched themselves on an eighty-eight day trajectory with a chemical rocket, obviously intending to use the Martian atmosphere in an aerocapture maneuver.

Many studies going back to the 1980s showed that was a terrible idea. It was too hard, they said, to design a big interplanetary spaceship that would fit behind an aeroshield. They said the density of the Martian atmosphere was too variable to plan a precise thirteen-kilometer-per-second aerobraking maneuver. Without it, they said the mission called for some thirty kilometers per second of total delta-V, and this required development of the nuclear-thermal rockets.

Halvorsen had laughed at them then, and now, apparently, had launched his own expedition.

"Mustaffa, one of three things will happen:

"First, and most likely, the Norwegians will kill themselves. They will either burn up or fail to be captured." Perhaps, for a fleeting moment, before good Christian conscience took charge of my thoughts, I even hoped that they would.

"Two," I continued, "if mainly by luck, they manage to reach Martian orbit, we will probably have to rescue them. There is no way a ship that small could carry enough fuel for a landing and return, even using aerobraking. They are counting on our supplies and our good hearts to steal a share of our glory." *We* would, of course, perform the rescue. Ungraciously.

"But, if all that is somehow wrong, the third possibility is that Halvorsen will make us look like idiots." Perhaps I feared that the most. He had been on the original planning committee, but as the expedition had gotten bigger, more complex, more expensive, more politically influenced by the member nations, and more compromised, he'd become more and more obstinate. As one of those experts, I'd had words with him. Finally, he had stormed out of a meeting and not returned.

Now he was saying, in effect, that he'd been right all along and that we'd spent a trillion dollars that could have been spent better elsewhere. I shuddered. If true, the media would dance on the graves of our reputations for years to come. That was the worst case I could imagine.

Imagination, however, was never one of my strong points.

"It will be as Allah wills," Mustaffa said. "But I, for one, will try to avoid doing idiotic things."

"*Sí. Zhang-D,* put a telescope on the Moon." We were already three million kilometers from Luna, but in a second, Mare Orientale filled the screen—three half rings bisected by the shadow line. It would be full Moon back home.

"Center it left of the Farside limb, and give me maximum magnification." Once the sunlit side of the Moon was off-screen, the video intensity readjusted, and I could almost see the shadowed lunar limb in silhouette against the star clouds of Sagittarius. Tiny specks of light flecked the farside of Luna now, explorers and settlements now almost a decade old. There was nothing moving, and for a moment I had hope that Halvorsen's announcement was a joke—Halvorsen paraphrasing what Amundsen sent to Scott a century and a quarter ago.

Then I saw them emerge from our Moon's shadow. Two spots of light, brighter than any nearby stars. They seemed to be moving slowly relative to each other as well as against the background.

A line flashed between the spots of light. What? Of course. It was the specular glint as a cable caught the Sun just right. Halvorsen, of course, would have used tethers for artificial gravity, after all our committees and systems analysts had decided they were more problems than they were worth.

"Put a dish on them and listen. Contact Mission Control. I'll be up to ops in a minute."

I slipped into my coveralls. We should have been informed. I would talk to Dr. Worthing, man-to-man, from the dignity of my command deck at the front of our ship.

But only three or four seconds had passed before, "Mission control wants to talk to you."

Of course. I shook my head hard to stimulate myself, pushed the door at the end of my cabin open and emerged from my cell at the aft end of the octagonal common room like a new bee into a hive. My hatch thunked shut and "Blue shift" crew members glanced at me from each of the four "floors" spaced at equal intervals around the hull. I tried to appear unhurried, and nodded to each of them.

There was a pole down the center of this to guide passers-by, but, in a display of the zero-gravity competence expected of a commander, I jumped for the ops hatch directly from my cabin door.

Command ops occupied the forward end of the cylinder, some nine meters away, and I prided myself on my ability to jump the distance without using the pole, shoot through the opening without touching its sides, and catch myself with my toes.

My little maneuver went unwatched above. Mustaffa was alone, twirling his moustache, his dark eyes intent on the command video display as Dr. Worthing of the U.N. International Space Authority gave their version of events. They, he said, “welcomed all space exploration efforts” but “were concerned about the possible complications of another mission, and in particular, one formulated with so many differences in basic philosophy.” This went on for a few minutes, then the ISA signed off.

“Nobody on the back line for me?”

Mustaffa turned toward me and shrugged. “What bureaucrat has the patience for a time lag between speeches? We have a half-megabyte download of instructions on how to handle press questions from the ISA. It’s GMT midnight at Earthport—the public relations people are asleep.”

“The press! Public relations! Caramba! What do we do about Halvorsen’s mission?”

Mustaffa shrugged. “It appears we are to continue for now as if nothing has happened.”

“But what if they. . . . Get a ground line. I’ll talk to Halvorsen myself!”

“Enrico, it is after midnight in Norway and he must be eighty—”

“Wake the old fart up!” I pursed my lips. Halvorsen, for all his obstreperousness, was a legend of space exploration. It wouldn’t do to display my anger to the crew. “I’ll take it in my cabin.”

I’d worked for the U.S. NASA for twenty-three years, but I was dark-complexioned, had straight black hair, and had retained my Argentine citizenship. This had made me politically acceptable as the U.N. expedition commander—and a target for some of Halvorsen’s criticism. So, if he succeeded in beating us to Mars, he would get back at me and prove me not only wrong, but unnecessary.

It took twenty minutes, but Mars Mission Control made the connection and I saw the old, straight-backed, craggy-faced, iron-haired descendent of Viking barbarians, dressed in a night robe, frowning at me in what seemed to be a living room. At least the backdrop was a great stone hearth strewn with models of rockets and Moon rocks.

I started by asserting my authority as leader of Earth’s official expedition and taking an attitude of outrage. “What do you think you are doing? Over.”

Forty seconds of light-speed delay gives one time to question one’s wording with no opportunity for recall. I was talking to a man many years my senior and an acknowledged legend. This was not a pleasant way to converse.

“Well,” he said, pronouncing his “W” as if it were a “V.” “I am sitting in my home listening to Grieg. Per and Ingrid are going to Mars. Over.”

The same crew that had gone to the Moon with him. Per Nordli was a cool, tall, diffident, brown-haired man. He had no cojones, but was otherwise respectable. But his wife looked and acted like someone more comfortable in a bikini than a spacesuit. Make that half a bikini.

“You sent that bimbo Karinsdatter!” I shut my eyes to regain my composure. I needed to interface with his technical staff on flight plans, to prepare contingencies, before we got too far away for comfortable discussion.

"Where are your people, your mission control center? I was told you are heading a mission control operation. Over."

While I waited for his response, I shuddered to think of the problem Karinsdatter represented. Our Mars expedition was full of men from developing Islamic, Oriental, and Hispanic cultures—and the sponsoring nations thought the first mission would be hard enough without sexual complications. We had carefully negotiated a decision not to include women on the first mission. Now Halvorsen, on his own, had decided otherwise. Bad enough—but for him to send Dr. Ingrid Bodil Karinsdatter, however theoretically qualified, to Mars was an unforgivable insult.

Yes, for some it would be insulting just because she was a woman. But the problem was more because of the *kind* of woman she was. After she had become famous, she spoke up for population control efforts in opposition to many of the religious leaders of Earth. She used a non-traditional feminist surname. She had posed for a magazine. I and many other NASA astronauts—especially the women—had publicly blasted her for that. In return, she had made comments about American prudery.

Was Ingrid Karinsdatter someone to dangle before forty men fifty million miles from Earth? Ten of my crew were from conservative Islamic countries. Now, in the Norwegians, I faced a culture whose ideals of womanhood were ski champions, marathon runners, Valkyrie warriors, prime ministers, or Viking queens with names like Aud the Deep Thinker. To that, add the crazy license with which all these modern European women display themselves now that the fear of AIDS has gone.

I stared, tight-lipped, at the large, but simple and spare living room behind Halvorsen, waiting for transmissions to go there and back. Finally he shrugged, almost as a Frenchman would.

"I recruited Per and Ingrid who were with me on the Amundsen Crater expedition. Their children are old enough to leave alone now and I am too old and too blind to do anything but think and talk. But I still do that not too bad, *nei? Ja,* I know how you talk of Ingrid. But that is your problem. As for mission control, this is it such as it is. I use my house computer and my videophone."

So their standing army was this old half-blind man standing in front of me. Who did he think he was? Goddard? Korolev? Von Braun?

"Oslo University," he continued, "is giving me time on their radio telescope and some volunteer help. That is all. We only have a two person expedition, assembled from standard modules. Over."

I frowned. The Norwegians had bought their way into space with oil money and a cut-rate single-stage shuttle design that NASA had smothered to death. It had a payload of five tonnes to a five-hundred kilometer orbit at best. And they'd hardly changed a thing since their Moon escapade. There was no way they could reasonably hope to get a round trip out of that, I thought. They were planning on using *us*—they had to be—and that made me angry.

"This isn't fair, Halvorsen. Our lives may be put at risk. Now will you tell Per Nordli to follow our lead; to do just what we say? So we can get him and his wife back safely? Over."

I waited. Halvorsen's expression changed to ice when he got my transmission. "*Nei!* We plan that they get back by themselves! As for putting lives at risk, you do things so stupid and complex it is *you* that may all die. That is why I walked out of your meetings. *Uf dah!* Bureaucrats, empire builders, and egomaniacs. Bah!" Across six million kilometers and through two sets of communications electronics, this craggy gray old Viking speared me with the contempt in his nearly sightless eyes. "It is too late to be talking such nonsense. Halvorsen out!"

The image dissolved to a UN link operator who told me that Halvorsen had hung up, not waiting for my signoff. In retrospect, I may have been too peremptory myself, but still, the insult stung.

I called a staff meeting to decide how to deal with the Norwegian expedition. It would take us four days to rendezvous with our Deimos supply depot, refuel, deploy our landers, and be ready to mount any kind of an operation, we reasoned. The Norwegians would most likely have trouble during aerobraking, so it would be best if we were in place before they got there.

Nobody wanted to call it a race, but we examined our trajectory margins to see if we could get to Mars earlier. But the trajectory people told us the time to have done *that* was in low Earth orbit. Now, it would eat into our reaction mass budget more than mission rules would allow. The Norwegians, it seemed, would get to Mars orbit before us. Dead or alive, but first.

Not if I had my way. We had plenty of fuel margin—there ought to be some way of stealing a little of that to shave some days off our trajectory. There was a planned midcourse burn only forty hours away. If it was just a little bigger. . . . I knew my way around mission planning bureaucracies—I called the man in charge of trajectory analysis and asked him if he could run some contingency cases that had looked good to us. Strictly hypothetical? I grinned at the planner and he grinned back. He wanted to win, too.

It looked good.

Two days later, I was smiling and it was Halvorsen who was angry.

"We plan so our ships will be out of your way. Now we all get there at once bam-bam and will all be so busy that no one will have time to help anyone! And you use up your fuel margin! Over!"

"You are mistaken in your exaggerations, Dr. Halvorsen," I answered, calmly. Dr. Obote, our ground orbit analyst, also exaggerated when he'd called to upbraid me for my non-nominal burn. But after a few Swahili expletives, he acquiesced to the *fait accompli* and participated in the "discretionary-modification-well-within-mission-parameters" official cover.

"My fuel margin," I continued to Halvorsen, "is *not* used up and we will arrive in Mars orbit well ahead of you.

For which you should be profoundly thankful if we have to rescue your people. Now that possibility is an *unplanned* complexity and need for coordination. Over."

I relaxed and contemplated our trajectory display with a smile. The arrival time difference was up to five hours, now—in our favor.

Finally, Halvorsen frowned and opened his mouth. "We have sufficient redundancies and do not require or plan on your help. You have enough problems just executing all you have planned. I ask you now to forget we are there and concentrate on *your* task. Over."

I prayed for equanimity in the face of such arrogance, and my prayer was answered—with the Lord's help, I did not lose my temper, but instead answered in measured tones. "I'm very sorry you feel that way. But we can't let past disagreements stand in the way. When we . . . I mean, if it may be necessary for me to rescue your people, I will need your cooperation. Over."

I waited a minute to hear him snort and shout, "Halvorsen out!" Touchy *hombre*, Halvorsen.

We watched the Norwegians on our telescopes as it approached time for their course correction. Our ships were getting closer every day, on paths that would arrive at Mars separated only by hours, and within the last week had gotten close enough so that our twenty-meter baseline synthetic-aperture optics could see the details of their ship's construction.

Each Norwegian ship appeared to be a bundle of four squat cylinders sitting on their ends in a saucer-shaped heat shield. Range and apparent angle told me the cylinders were each about four meters tall and two meters wide. The cylinders were capped by transparent domes, through which we could occasionally make out one or both of the crew members. There were four holes in the heat shield, one under each cylinder, apparently for the rocket exhaust.

The ships were tied "nose"-to-"nose" by a tether almost half a kilometer long, rotating every fifty seconds; at high magnification, it was like watching the second hand of a clock move. We expected to see that clock stop and watch the Norwegians dock, untether, undock, do their burns, rendezvous, redock, re-tether and, in what should be one of the dicier maneuvers in astronautics, reestablish their tethered rotation. I looked at the clock—they were seriously behind schedule if they were going to meet their window. Had something gone wrong already?

Suddenly, one of the ships spouted fire for a couple of seconds. The acceleration was apparently much less than their centrifugal weight, because there was no sign of slack or vibration in the cable. Twenty-five seconds later the other ship also fired when its engines were pointed in the same direction as those of the first ship when it had fired. This went on for five cycles. Nothing wobbled, nothing broke. Mustaffa, as dumbfounded as I was, looked from the bridge video to me, and back again.

I shook my head. I had no idea of

how complex their internal procedures and checks were, but the operation viewed from outside was simple to the point of elegance—yet our engineers had justified management's position of not trying spin gravity by citing the complexity and uncertainty of doing such maneuvers. It was something that had never been done before with a manned spacecraft.

Well, now it had—and that tight spot in my stomach that had materialized as soon as I heard of Halvorsen's mission grew a little tighter. We were up against someone who did not live by the rules of managers, politicians, and tame engineers. He did not respect the zonas intangibles. He and his people could do things we could not. It wasn't fair. I thought about Ingrid Karinsdatter. It was most definitely not fair.

Midway to Mars, I was forced to hold a disciplinary hearing. Planetologist Kadir Ibn Muhunnad caught Sajag Kedar, our biotechnician, examining the Norwegian ships at maximum magnification, something that would have attracted no adverse notice except for the data he saved.

I must explain. The Norwegian ships were still somewhat sunward of us and the Sun was in the plane of rotation of the tethered ships, plunging their domes into shadow for about ten seconds each revolution. During this time, glare vanished and one could see inside. The Norwegians seemed to use the dome for relaxation—as a Sun deck mostly—there were plants and acceleration couches, but almost no visible equipment.

Whether Dr. Karinsdatter was aware of our surveillance, or whether she would have dressed more modestly even if she had been aware of it, is a matter of conjecture. Our telescopes were larger than those the Norwegians carried and I doubted that either of them had thought that we could observe them; we must have been just four very bright stars from their point of view. But Halvorsen, who sent them to plague us? He might have thought of it. Oh, he might have.

In one of Sajag's five-second clips, Dr. Karinsdatter, alone on her couch, chanced to look through her bubble, across the megameter of space between us, through the optics and the electronics, from the view plate, and right into my eyes. It was obvious from what she was doing that she had no idea that anyone was looking back at her at such high resolution. Still, I felt taunted—and much more.

"In my country, she could be shot for this," Kadir told me—as he viewed the video evidence just as compulsively as everyone else. "It is her responsibility not to be seen in such a way."

Sajag was removed from the telescope schedule, but I am sure he was just the one who was careless enough to be caught. We all had access, and we all had times when we were the only ones awake on the ship. Several of us had valid reasons to be studying the Norwegian ships. We edited the logs after the hearing; common sense decrees that not everything be saved for posterity. Not only that, but we did not want to give Halvorsen the satisfaction of knowing what he'd done to us.

The Norwegians gradually passed

below us and drew away. Their midcourse maneuver had put them slightly ahead for now, and my hopes for getting permission for an autonomous catch-up burn were about nil. But I was sure I could slip a few more meters per second into the next scheduled one.

Another month had passed. Mars became a small, reddish moon to our eyes, and in our telescope, we seemed to fly over its surface. The communications time lag was approaching its maximum of six and a half minutes. Soon Earth would pass sunward of us as we coasted uphill to our destination.

We watched each other, we and the Norwegians. Officially, we pretended they did not exist. Unofficially, forty men envied Per Nordli more and more, and praised our mission plan less and less. We had a few heated arguments, and a broken nose in the *Leonov*.

The Norwegians made no attempt to talk to us either. But time had not solved anything, and I had put off making my contingency plans too long. Our final midcourse maneuver was scheduled in two days and things would be too busy then, and too locked in concrete, to coordinate any trajectory changes with the Norwegians. I called Halvorsen.

With almost six minutes between sender and receiver, one doesn't wait for greetings before proceeding to business. After my testy preliminaries, I asked, "Can you at least tell me what kind of parking orbit they are going to try to achieve? We may be able to match inclinations. Over."

Hopefully time and a little conciliation would put the conversation on a professional basis. We needed to make plans and the communications round trip was eating up time.

His eyebrows went up and a hint of a smile crossed his face. "Commander Lopez, I provided all of this data to Dr. Worthing and your mission control two months ago. Per and Ingrid are not going into a parking orbit. They plan to proceed directly to the surface. Parking orbit is a backup. Over."

"What?" With Halvorsen, I should not have made assumptions. He stared out of the screen at me as, somewhere deep inside me, a sense of doom started to form. I was dealing with a different kind of human being, a leader who dealt with the laws of nature directly, instead of through intermediaries. Everyone's mission plans went to parking orbit—everyone's except Halvorsen's.

History assaulted my mind when I saw his craggy, ancient face. Some recent—Halvorsen's own incredible lunar south pole mission twenty years ago. But in the mists there were Amundsen, Nansen, and, of course, Leif Eriksson. As to why Dr. Worthing had not told us? He presumably feared what I might do to make up the time. He feared right.

"Did you receive?" Halvorsen asked. "You are silent too long."

I had forgotten to say "over" and wasted six minutes. I shrugged my shoulders, and struggled for internal peace. I was not an inexperienced astronaut; I led explorations of several major lunar features and was second in command on the mission to the asteroid Eros, the trial for this mission. I'd had all the resources of the United Nations behind me. There was no reason for me to be flustered. But I sat there in front of the screen pickup open-mouthed.

"Well," he continued, "the whole thing I will run through while you figure out what you say. *Ja,* ten years ago I left the ISA Mars conference. We have already discussed why. Then I talked to our prime minister who nodded his head to some things and shook it to others. Our space program is a matter of national pride, *ja,* but it has to be a not-so-expensive program.

"So, officially, I had the go-ahead to do a small Moon base. The Italians have one, the Tysker, the Nederlanders, even the Svensker!" Halvorsen scowled at this, and it was my turn to smile. If you look at the Scandinavian peninsula, you see not golden fields of Nordic brotherhood, but a line of tall mountains down its middle.

"So our little single-stage-to-orbit *Norgedraken* flew ten missions and twice docked four payloads to big composite disks. Then we sent them both toward the Moon. You remember?"

Very well, I remembered. It had been a fiasco. *Both* their seven-million-kroner base modules failed to make nominal Lunar Orbit Insertion burns and had whipped by the Moon out into interplanetary space. It had been such a loss to the minuscule Norwegian space program that observers thought that it would pretty much end the thing. But their parliamentary committee had met in closed session and voted more of their oil money for a second attempt.

The old man's face broke into the grin I would expect to see on the face of Satan himself when he acquires Halvorsen's soul. "Well, our real plan that was not, *nei,* nor did anyone notice where the so-called Moon base modules went after they picked up a couple of kilometers per second rounding the Moon." Halvorsen raised his eyebrows and I got a sinking feeling as I remembered that the date of the Norwegian Moon base "failure" was within a month of our own Mars supply staging mission.

Halvorsen continued. "Everyone said Halvorsen screwed up. *Ikke sandt?* Not so? Well, we let them think that. Now I will put on the animation of our mission." Halvorsen's face was replaced by a cartoon of the "Moon" mission as he narrated. "The big disk was not just a docking structure, it was an aerobraking heat shield, which is how one should go to Mars. I say this to you ten years ago, but all your big rocket companies and everyone who wants to work for one someday say, 'no, no, too risky.' So you then buy lots of big rockets, *ja?* Well—"

As the trajectory lines on the animation bent past Luna toward Mars, I forgot myself. I yelled at him despite the fact he hadn't finished talking. "Halvorsen, damn you, we only bought *five* ARIES heavy-lift launch vehicles!" He wouldn't hear that until I was well into regretting I said it, of course.

". . . Our ships have a mass ratio of seven and an exhaust velocity of three kilometers per second. That gets us to

Mars fast, easy. We do some phasing pair burns to make sure we hit things right. Then we go right into the Martian atmosphere like the American *Apollo* returned to Earth, except we use negative lift to hold us down if there is not so much atmosphere where we come by. So, if air is thin, we skim the mountain tops and get at least capture, then hit our target on second pass, but if average, or more dense, we can land first pass. No matter. After we reach terminal velocity, we use rockets for the last half kilometer per second. The computers they need for this simple stuff weigh only a hundred grams now, so we take five each.

"The supply ships were the trial run for the crew ship. They left two tiny satellites in egg-shaped half-Mars-day orbit with their high points at that latitude, good for communications relay and reconnaissance. Then they left four full fuel tanks in low orbit and landed on Mars to make more fuel for our return from carbon dioxide with their solar cells. This is not very efficient, but, with two years to do it, the ground base tanks are now full. This is simple, *ja?* Now Ingrid and Per will go to the bottom of Chryse, as you do, *ikke sandt?* But they will go straight down. Now—"

My outburst about the heavy lift vehicles arrived then; I could hear my voice in the background. He frowned, then grinned. "*Ja,* well those big companies with the jobs, what did they build next?" He shook his head in exaggerated sympathy. "Back to Ingrid and Per. They can get themselves there and back with plenty of redundancies and no need for you to be concerned. Our ships we can park in Earth orbit and use again in two years. It is your super-complicated one-time mission about which you need be concerned. Over."

There was too much for me to digest, and no point in discussing things until I had.

"I copy. Thank you for the information, Mr. Halvorsen. Over and out."

I signed off with mixed feelings. My Padre taught me to "not tempt the Lord by putting yourself where only He can rescue you." Good advice in the cold scrublands of Patagonia, and good advice here. Despite Halvorsen's contempt for conventional political and moral authority, the concepts of forethought, at least, were not foreign to him. "Plenty of redundancies," he'd said. I would hope.

In concept it *was* simple. Elegant. The ISA called it MSR, for Mars Surface Rendezvous, and dismissed it as too risky. At first, my mind boggled at a Mars surface refueling operation. But with everything tied down by Martian gravity, I realized it might actually be less tricky than a tank-module swap on Deimos. As I reviewed Halvorsen's video, I realized the large spider legs on their supply modules placed the tanks higher than on the *Amundsen* and *Fram,* allowing a passive gravity feed. The compactness of their deceptively simple design impressed me—the same piece of mass often performed two or three functions.

Their base was not too far from where we planned to land, so a rescue contingency would not perturb our mission plan very much. There were only two of them, and they already had their own supplies down. In fact, and this was the first time I remembered thinking in these terms, while their expedition was minuscule compared to ours, they had a *lot* of stuff for only two people.

Halvorsen's sign-off arrived as I was thinking it through. "Commander. What is now done is done. Mars will be a hard enough opponent, without false pride to fight as well. I tell this to Ingrid too. You should know she is in charge overall. She is the older, and has the broader education, and is a better English talker. Per is the best pilot and likes to do orbits and numbers mostly, though he can do the other too in a pinch. No matter. They do the job. If you meet my people, you will find Ingrid not so hard to work with."

I stared at the screen speechless, not believing what I'd heard. Halvorsen's commitment to women's equality was well known, and it was one of the many issues over which he had pulled out of the UN project. He felt an all male expedition, especially a large and long one, could become too restive, too grumbly, too combative. But third world politics had gone against him, and he had stomped out. Now he was having his revenge by decreeing that I would have to treat this woman, whose mores and deportment I had publicly criticized, as an equal.

Not likely. It was far easier to simply ignore them, which is what we did for the next month, as we approached the Red Planet.

Mars loomed bright and full as we rose toward it from the Sun. Our nuclear reactor shadow shields did double duty as we rode out a minor solar flare. In fact, it turned out that for the entire mission, the lowest total radiation dose was in the cabins right next to the reactor shield—because it stopped half the cosmic rays as well.

We learned later that the Norwegian ships had superconducting magnetic loops that channeled the proton influx harmlessly into their heat shield, behind their propellant tanks. Another "unproven" technology, but not only did it protect the Norwegians, but they actually gained a few centimeters per second push from the interaction of the charged particle storm with their magnetic field.

Little good would that do them! Doing midcourse maneuvers with our fleet is not trivial, but I found need for another one. I was a demon: I sold it to Dr. Worthing and pushed the planning through with two sets of books—the vector I intended to use would get us there a little earlier.

Four countdowns had to go perfectly, everything forty people have spread around had to be stowed, four computers needed to agree on everything—it takes days of planning. But under my leadership it went perfectly, and it added just enough delta-V to get us back ahead of the Norwegians without creating big political problems for Mission Control.

The "race," of course, had assumed David and Goliath proportions in the Earth media, and guess who was cast as Goliath? I was obliged to do interviews in which I decried any competition and said conciliatory things about "my colleague, Dr. Karinsdatter."

When, as a result of our "nominal" and "planned" maneuver, we gradually pulled away from the Norwegians, the media cried foul. However, by that time, they could do nothing but throw words at us.

Not so Halvorsen. I was in my cabin ten days before our Mars orbit injection when the Norwegians threw us yet another twist. We watched it on the telescope, recorded it, and I'm still not sure I believe it: the Norwegian ships separated without despinning! The one on the approaching leg of its rotation just let go of its tether, and its rotational velocity instantly became additional velocity toward Mars! It was like a stone released from an ancient sling, headed right toward my heart.

I stared for five minutes, then played the file back again. "Give me the revised arrival times," I finally told the computer.

It was as bad as I feared. The lead ship, the *Amundsen,* had gained only about thirty meters per second, which would still leave it still more than a day behind us when we got to Mars. The trouble was that they were planning to go right down if they could, and we were going to do parking orbits, surveys, transfer to landers and so on, before actually going down. If all went right with both our plans, our first landings would take place within hours of each other—theirs first.

I stared at the screen and composed my thoughts for the next call. It would not be my place to educate the ISA leaders under whose authority I commanded this expedition, but the experienced astronaut within me was saying that the Norwegians had a chance. I needed to break the news gently.

At least, if their landing was successful, it would minimize the perturbations of our extremely complex and interrelated mission plan.

But on the other hand, our expedition would not be first, and I would not be the first man to set foot on Mars. Once more, I reviewed our mission plans, the Martian weather, where our landers were and so on. There was still a chance, *if* the lead Norwegian ship didn't touch down on the first pass. That, I thought, would depend on Per Nordli's skill and nerve.

Not exactly, as things turned out.

The simultaneous deep space restart of our nuclear rockets was ten times as complicated as the chemical midcourse maneuvers. But we did it without incident, silencing many critics. One after another, our ships turned their damping drums and their reactors went critical. A trickle of hydrogen flowed into the particle beds to cool them and run the turbines. The computers did a million cross checks. Deviations were within nominal limits.

We passed the orbit of Deimos—twenty thousand kilometers out—in good form. We would meet the moon itself, with our supply depot, after our main engine burn at periapsis put us in an elliptical transfer orbit. At Deimos, we'd do a short circularization burn with our chemical auxiliary propulsion and "land" on the tiny moon to take on propellant before sending landers to Mars. That was the plan.

Our Phobos camera sent a picture

of our four ships with the volcanoes of Tharsis in the background; it was a spectacular picture. I felt a moment of triumph. Our majestic convoy, the symbol of Earth's pioneering spirit, was headed in to mankind's new planet!

This impressive close formation approach, however, had been another "discretionary" part of the mission plan. Originally, the ships were going to come in at one day intervals. But that would have meant another day before I reached the surface.

My moment of triumph was short-lived. Hours before, the *Amundsen* had made a final course correction—an expected maneuver given the chancy aerobraking ahead of it. But the trajectory report indicated that the *Amundsen* had actually done a major burn *toward* the planet! The burn had cut hours off its trajectory, but it would hit the Martian atmosphere at a slightly *higher* velocity, just an hour before our burn. So the Norwegians weren't racing? I thought about negative lift and velocity-squared aerodynamic effects and could guess that something besides the race might have led them to this suicidal dive into the Martian atmosphere, but it wasn't very convincing. No, I decided, Per Nordli was taking this risk so Halvorsen wouldn't lose his diabolical little race.

¡Madre diablo! Given the way he managed all the other news about the expedition, couldn't Dr. Worthing have held *that* announcement back from us until we were safely in orbit?

But no. As we approached our eight-hundred kilometer periapsis, the *Amundsen* went past us, rounding the rim of the planet. We watched its entry on images from the robot telescopes on Deimos—a long trail of fire covering almost a quarter the circumference of the planet, which then winked out.

Had the *Amundsen* crashed? Had it burned up before reaching the surface? I both feared, and—forgive me—hoped that might be the case.

But no. We saw the landing pictures taken by an automated camera on the Norwegian supply ships and relayed from Earth just as we prepared for our insertion burn. Then there was that historic video from the cabin of the *Amundsen*.

When Halvorsen has a point to make, he doesn't go half way. Despite his talk of Per being better with piloting and trajectories, the first person to land on Mars with the Norwegian and United Nations flags on the side of her ship was Dr. Ingrid Bodil Karinsdatter.

"May their malfunctioning toilets line their vacuum tents with their own dung," Mustaffa muttered. But other than that, there were just stony looks all through operations.

We were demoralized. We'd lost a race we hadn't known we were in until it was too late, and we'd lost it to someone we regarded as a bimbo. If you are European, perhaps you say, "So what? That's a juvenile attitude. Professional astronauts shouldn't be fazed by that." But most of my men were not from your culture; their pride had been wounded and their values insulted—and we still had a great many very complex things to do.

Spacecraft had to be prepared for

thrust after four months of no gravity. Countless things were stowed. Chairs were moved to the aft bulkhead. A myriad of checklists were executed. Finally, the count reached zero.

On the *Zhang-Diaz* a gentle thrumming vibration took hold, and a sense of down returned. There were disturbing clatters and crashes as things forgotten fell aft, but the thrust ramped up smoothly. The other ships kept pace and formation. I crossed my fingers and hoped the blow to our morale would have no effect, at least not now.

Perhaps it would have made no difference, but perhaps if the crew of the *Leonov* had been mentally and emotionally sharp, they would not have missed some things and a water bulb would not have fallen from the sill of a viewport and broken on a relay box that should have been closed, soaking its contents as thrust increased.

And the pilot would not have switched circuits to their backups in exactly the wrong order, causing the *Leonov*'s lander to separate when deceleration built up to half a gee.

And the lander would not have continued forward to strike the decelerating *Calypso*.

And the suddenly lighter *Leonov* would not have moved backward relative to the *Clarke* and into the exhaust of the latter's nuclear rocket.

And the radiation level monitors aboard the *Leonov* would not have shut down their reactor before they had braked into the proper orbit, forcing them to complete the burn with what remained of their maneuvering fuel.

And the *Clarke*'s computer would not have shut down *its* engine to avoid endangering the *Leonov* when it found the latter spacecraft in its exhaust cone.

Caramba! Perhaps something like that would have all happened anyway, as Halvorsen anticipated, because of the complexity. But I think it was because we were on edge, unhappy at losing the "race," and already dreaming about getting home.

The *Calypso*'s chemical propellant tanks ruptured, but they somehow retained attitude control by gimbaling the main engine, avoided hitting the Martian atmosphere, and limped into a high equatorial orbit. Mustaffa cut our burn short manually to follow them and, using prodigious quantities of our maneuvering fuel, we managed a rendezvous.

Pierre Ramon and Mustaffa went out in vacuum suits, and managed to bring the six survivors over before their leaking hull finally gave way.

So the rescue was an epic of astronautics, but it left the *Calypso* ruined and the *Zhang-Diaz* in a too-large eccentric orbit with almost no chemical propellant left. Rendezvous with the supply depot was now impossible.

The *Clarke*'s maneuver had been stopped short of capture and they now had to take the emergency return trajectory back to Earth. The name of the ship's commander was Roger Moses—another irony.

But the *Leonov* did manage its rendezvous with Deimos and the supply depot—one out of four. By the time

Mission Control and my staff had straightened everything out, we had lost two days of schedule time, two spacecraft, and three landers, including both wheeled surface vehicles.

And where was Per Nordli? He was ten hours behind in the other Norwegian ship, the *Fram*. Halvorsen had told me they had their own redundancies and were not relying on us. I had not thought that through, but now it made sense that the better pilot come in second, in case a rescue was needed. He demonstrated his mastery by declining a one-shot landing; he skipped out into a long elliptical orbit that matched ours, and offered assistance. But Mission Control determined that there was nothing his little ship could do.

Meanwhile, some of the *Leonov*'s crew reported exceeding their radiation limits and the doctors recommended that they go to the surface or return now. They voted to stay.

Perhaps we should have aborted the mission entirely, but I railed against this. To come so far. . . .

No! I was a whirlwind of orders. We would fight back from disaster. We launched all our automated probes, balloons, and teleoperated rovers at once. They sped toward Mars well ahead of us, and data started streaming in as we passed the atmosphere-grazing periapsis of our orbit. Good news started to displace bad news.

Dr. Worthing sent out press releases that emphasized the redundancy built into the mission and the superior technical equipment in the United Nations landers versus those of the Norwegians. We expressed great sadness for our casualties, but dedicated the remaining mission to them.

I took risks. The *Zhang-Diaz* was trapped in an unusable orbit, but had a usable lander. My staff came up with a brilliant improvisation: The *Zhang-Diaz* lander could do an atmosphere-assisted orbit change to rendezvous with Deimos and the *Leonov*.

Once at Deimos, the lander could take on fuel and that would at least give us the *option* of a landing. Since there was no point any longer in pretending that such maneuvers were too uncertain for manned spacecraft, Mission Control quietly acceded—just in time for us to follow our fleet of drones into the atmosphere on that first periapsis.

Within twenty-four hours, we had a fueled lander ready to go. But Mission Control still objected to a one-lander surface mission in such circumstances.

So I went up to the political level to postpone a negative decision—no need to admit failure yet. A good face was put on everything as I worked furiously to get myself and some volunteers down to the planet. Of course, there were some minor drawbacks that never made the press releases. All that superior equipment was not on that one lander. The one that survived had an aircraft instead of a rover; so once we got there, we would have to walk where we couldn't fly.

Thirty hours after her landing, we watched Dr. Karinsdatter step off an *Amundsen* landing pad to gather samples. This told us that the Norwegian expedition had succeeded to that point, and put the final nail in the coffin of any remaining hopes for us—no one from our expedition would be the first person to set foot on Mars. A woman, instead, would join Gagarin and Armstrong in the history of space. My country once had such a woman as its presidente. It was not a successful experiment.

Boris Yakov, the *Leonov*'s commander salvaged some glory for us. He went outside and left a footprint on Deimos.

Meanwhile, Dr. Karinsdatter roamed around her camp on the Martian surface in a pedal-powered, wire-wheeled tricycle, collected multitudinous samples, released some mini-balloons and transmitted a fair amount of surface data to that radio telescope north of Oslo herself.

Never mind the dollars per bit; our army of robot floaters and crawlers got far more data in absolute terms, and that is still coming in. We won in what counted.

We learned that one of the Norwegian supply landers had fallen into a sinkhole, and we made much of this with offers of assistance to Halvorsen. The answer came back that he thought no assistance was needed, but that we should talk directly to the people on the scene.

Finally, two days after we braked into orbit I declared the remaining lander ready for the descent. We were determined to make one quick strike for the goal. The public, the politicians, and ourselves would feel like failures if we didn't.

Five of us went down instead of the seven the mission plan called for. We said we had to do this to leave room for the Norwegians whom we might have to rescue—but in reality, four of the seven *Leonov* personnel with ground training asked to not be included in a one-lander mission. Despite their radiation exposure levels, they felt the protection of the Martian atmosphere was not worth the additional risk. Mission control did not dispute this.

At last I called Dr. Karinsdatter on the surface. Her base computer answered and the view from its comm camera filled my screen. It was a late Martian summer evening and I could see rolling hills and the dusty red horizon through their transparent inflated dome. For a moment, all the problems went away. This was why I had come.

"Commander Lopez?" Her voice came from off camera.

"*Sí*. I was admiring the view. We are going to descend in six hours, at local dawn. Is there anything you need?"

She walked up to the comset with a Martian rock in her hands. She had apparently just come in from sample gathering. Her hair, matted and disheveled, was still tied behind her head in a pony tail that fell to her shoulder blades and she was wearing only the thin body stocking the Norwegians used under their tight vacuum suits. It both covered her completely and revealed everything—and she seemed utterly oblivious to what effect this might have on us.

Mixed feelings ran through me, and eventually resolved themselves into anger. I saw a brief frown of puzzlement go across her face as she reacted to my expression.

"Cover yourself," I demanded. "This

circuit is open to my crew, who have not seen a woman in over six months."

She shrugged her shoulders. "That is not my fault." There was little soundproofing in our ships and I heard the men's reaction. "Perhaps they would enjoy seeing me then, Commander. But very well." The picture disappeared and I lost both Venus and Mars in one instant of self-inflicted pain.

"At any rate, Commander," she continued, voice only, "this is an independent and self-sufficient expedition and we will get along better if you do not try to give me orders."

I ignored this challenge and went to business. "We will come in from the west, from over Kasei Vallis."

"*Ja,*" she answered, seriously. "Beware—the ground here is crusty with cavities beneath. We had one supply lander tilt because of that. You may wish to land south of our position—we have traversed the area several times and the ground . . . it is mostly solid there."

I was irritated and unthinking. "We will make our own evaluation. If you continue to insist that you are in no need of our assistance, then I see little point in continuing contacts which would only be uncomfortable for both of us, I assure you."

She ignored the taunt. "Per and the *Fram* will be arriving in four hours—you have the vector?"

"Yes." Halvorsen and Worthing had buried some hatchets, and information was flowing now. "Give Per Nordli my regards . . . and my sympathies."

"Commander, I regret any affront I've given you. Please, when you land, we will welcome you. I take no offense. Is this understood?"

Somewhere in the back of my mind, warning bells began to ring. Best not burn bridges. Christ allowed such a woman to wash His feet, I remembered belatedly. But that woman was repentant.

"Very well." In the end, Thy will, not mine, be done. "I shall do what I need to do to bring back as many of us and as much data as I can. Rest assured of that . . . Dr. Karinsdatter. Lopez out."

"*Lykke til,* commander. Luck to you."

We would have to do all our ground exploring by foot, I thought. I did not want to take Norwegian leftovers, so we would have to traverse new ground. That way we would gain unique data and perhaps, hope against hope, find something which they had not found.

I put it that way to Mission Control. They told me no, land where the people on the ground say.

Did they take me for a child? I appealed to the political level again and got my way. I had not yet learned humility. That came five hours later.

We came in north of the Norwegians, in an uncratered area that was free of their tracks. Our computer gave us a textbook, fuzzy-logic-smooth landing, and I congratulated myself for not having to touch anything. It was not so bad, I told myself. Eriksson had been five hundred years ahead of Columbus, Amundsen a month ahead of Scott, but we had closed the gap to a couple of days.

Then a patch of thin crust gave in

under the weight of our plus-zed landing leg and our fuel-laden lander tilted, stopping sharply when the unsupported leg hit the permafrost under the dust crust. A strut bent upward under redline stress, snapped, and impaled an oxidizer tank with its upper ten centimeters. Red fuming nitric acid flowed onto the already well-oxidized Martian soil and reacted in a way that produced more smoke than heat. But it looked spectacular.

Without pressure in the tank to hold it against the lander cabin's Earth-normal atmosphere, the lander floor bent down, and cracked. Our escaping air vibrated the sides of the crack like a monster oboe reed as it escaped, to be replaced by nitric acid fumes. It sounded, felt, and smelled like hell.

With the fortune of prudent and well-rehearsed planning, we were wearing our spacesuits so we were not immediately harmed. I blew the lock doors and led the crew out onto the red soil away from the lander, in case there was an explosion. But no, the oxidizer just ran out and fizzled as we watched.

"Enrico," Mustaffa said later, in an unfortunate attempt to lighten my mood, "at least this makes you the first *man* to set foot on Mars."

The spacecraft shuddered and settled again. We watched helplessly as our two-man aircraft pulled free of its upper latch and pivoted down, breaking its back when its nose slammed into the ocher soil.

My look must have been as cold as the permafrost outside.

"My apologies, commander," he said quickly, after he saw my face.

Unfortunately, since the lander used the oxidizer to fuel its generator and the battery leads were cut when the floor buckled, our power was gone. Our communications plan did not call for spacesuit-to-orbit communications. The plan was to relay communications through the lander, which had triply redundant transmitters. In the impossible event of a triple failure on one lander, the backup was to relay through another lander—the one that was now on its way back to Earth in the *Clarke*.

Per Nordli's *Fram* came in overhead as we milled around our stricken lander. We could actually hear the ticks of his sonic boom—reminding us that we were on a planet with some atmosphere. We waved up at him like mad monkeys, but he was gone in a moment, over our horizon, far ahead of his shock wave. So now there were three manned spacecraft on Mars. Even in those circumstances, I took time to wonder at what we had been allowed to accomplish, and give thanks.

It was into the early afternoon before we gave up on trying to revive any of the lander's systems. We had suit battery power for about three more hours. We could walk in the suits without power for a little longer than that, straining against the air pressure in a kind of penguin shuffle. Our air could last a little longer than the batteries but not much.

The only choice we had was to try to trek to the Norwegian base. They couldn't see our problem, because, of course, we had taken pains to land ourselves just below their horizon. We couldn't radio them. No matter—our digital suit radios were encrypted for privacy. I briefly considered trying to telegraph some kind of primitive code by cycling my transponder—but I didn't know one.

It was a long walk, even in four-tenths of a gravity. Our suits were heavy, and we had to be very sparing of the power assist. We were all tired, scruffy, and unwashed. A few were injured. Some of us exceeded the capacity of the waste management systems built into some of our suits. I shall not try to describe the way we smelled. We didn't know if anyone else in the Universe knew we were still alive.

The historical parallels are endless, and great fun, I know. I led the bigger, more expensive, and more technologically advanced expedition, but I ended up seeing just what Scott saw. I think I understood the mixed feelings Scott must have felt as he approached the South Pole a century and a decade ago, when I saw the white-bordered blue cross on a red field painted high on the side of one of the *Fram*'s tanks.

That flag had signified both the failure to be *número uno,* and the success of gaining his goal to Scott as well. It was in such a mental state that I approached the inflated plastic dome of the Norwegian base as the frigid Martian night began to descend on us. Our power was giving out, cold was seeping in, pride was gone, and there was only the business of survival.

The Norwegian base was half a kilometer from their ships, and it was a mess. Pieces of the partly disassembled supply landers lay strewn about. There were hoses going this way and that. Empty containers lay where they had been unpacked. They seemed to have put little time into being tidy. On the other hand, there may have been a pragmatic purposefulness about the seeming clutter—anything important was in plain view and could be reached directly from their dome's air lock.

The transparent dome was double-walled, and within that was a small white tent which seemed to be under positive pressure. It was also moving gently back and forth—clearly, we were not expected.

But we were running out of air, and there was nothing to do but bang very hard on the outer airlock door. A trillion dollars, twenty nations, thirty-two men, and eleven months in space had come down to this moment of low comedy as our group of five desperate beggars shuffled like arthritic penguins up to someone else's door. I did not quite appreciate it then—I was freezing and tired.

The Norwegians thought that something was wrong with their equipment and responded to the noise immediately in hurriedly donned pressure gear, helmets in hand. Dr. Karinsdatter came out of the tent first. She clearly wasn't expecting to see us and the power assisted hard suits look somewhat alien at first glance. It must have taken her a minute to close her mouth and open the outer air lock door.

I came through last, as was my privilege. Strangely, I did not start shaking uncontrollably until I was out of the frigid suit and into the warm air of the Norwegian base. But what keeps going through my mind is not the low comedy, but the sad, haunting melody I heard as I came in from their airlock to safety. Grieg, of course. Solvejg's song, which will always be Ingrid's song, to me. It matched my mood of remorse and humiliation.

By midnight, we had rigged emergency sleep sacks for my men from mylar blankets glued edge to edge, and settled them just inside the west perimeter of the dome. We ate a meal of reconstituted pasta and meat sauce that tasted extraordinarily good, as any meal will under such circumstances. I took a stimulant, notified our surprised colleagues in orbit that I was still alive, and began to analyze the situation and to evolve a course of action—but the next thing I knew, I was turning over under a blanket and it was morning. Dr. Karinsdatter was hovering over me with a communicator.

I found my embarrassment at begging shelter in the Norwegian's love nest was nothing compared to what happened on Earth while I was asleep. Dr. Worthing's initial effort to have the UN take over command of Halvorsen's mission was resolved when Secretary-General Ryskoff secured Dr. Worthing's resignation and put Halvorsen in charge of both missions. Halvorsen found out which department heads could still fit into engineering hats and put them to work with their people to get us back safely. The others stood aside and watched.

Per thought that he had enough tools to fix our lander, if we could get fuel to it. But they were using carbon monoxide and liquid oxygen, while we were using hydrazine and nitric acid.

To find out that this had been a consideration of Halvorsen's from the start was another suitable lesson in humility for me. He had designed the *Amundsen* and the *Fram*, as much as anything else, as a lifeboats for *us*, in anticipation of our failure. So much for one problem.

But once back in Mars orbit, we would have face the fact that we had, essentially, two and a half UN crews and two UN ships, one stuck out in an unuseful orbit almost out of maneuvering fuel. While Dr. Karinsdatter was seeing to my crew, I spoke to Per.

"My plan had been to take the lander back to the *Zhang-Diaz* and transship propellant from our supply depot. But that lander will not fly again. Can the *Amundsen* ferry fuel?"

"*Nei*. To go out to Deimos, circularize, then go back towing a large mass so we cannot aerobrake, and then burn back to Earth? We do not have enough fuel for that. The *Zhang-Diaz* has its nuclear engine; why not use that?"

"The design is for only two more restarts, maybe three in a crunch. It's a thermal cycling limit—after six or seven cycles the inner frit starts to crack. It was a trade that let them make the engines lighter and more powerful—they only needed four burns. So a main orbit transfer maneuver would need two more restarts which would likely lead to an engine failure during the Earth arrival maneuver."

"*Ja*." Per smiled at me, this man whose only passion seemed to be this kind of technical problem, and that passion a mild one. "But you still have the reactor on the *Leonov*, powerful enough, I think, to get you all back. And you have the fuel and crew modules on the *Zhang-Diaz*. So, how do we now put all these pieces together?"

We spent the day with computers, drawing screens, and styli, and came up with a plan to send to Halvorsen. We left it with the Norwegian's computer to send, then turned in.

Halvorsen then called me in the middle of the Martian night on one of the spare comm units the Norwegians had given me. The man could do a clinic on revenge, I think. I got some minor satisfaction by getting Per up to hear it, too.

"OK," he began once I was coherent. "Your *Zhang-Diaz* uses its main engines to push itself and the *Leonov* to almost rendezvous with the supply cache, then separates the reactor module. Then you complete the docking with chemical rockets. You fuel both ships, then you depart using the *Leonov*'s nuclear engine. Over."

Per joined me, as blurry-eyed as I. The inside of the dome was warm with bodies, overloading the Norwegian's small recycler—I smelled not only my own body but everyone else's.

We were all down to shorts.

"*Sí*." I told Halvorsen. "Its engine can get both spacecraft to Earth if it can use the fuel left in the *Zhang-Diaz* as well as its own." This much Per and I had discussed.

"But, Dr. Halvorsen, to make this work, the fuel remaining in the *Zhang-Diaz* has to be pumped into the *Leonov* and we can't pump under zero gravity. We must use the reaction control thrusters, or the weak gravity of Deimos to settle the propellant first. Once under thrust, the pumps work. But now we don't have enough reaction control fuel to sustain that much pumping time. Over." Minutes passed as I regretted using up my extra margin in the vain effort to get to Mars first.

Finally, Halvorsen's answer arrived: "*Ja*. Your technicians said that was the only way to pump fuel. But then they said it can't be done under main engine thrust because of where the thrust vector would have to be with the ships tied together. You have to gimbal the *Leonov*'s engine hard right, to put the thrust line through the center of mass, but the pump will shut down if the gimbal is more than five degrees, no? A safety measure."

I remember those cold blue eyes staring at me from the screen.

"*Uflaks*. So you have to think harder. I think you know now well enough to look beyond what things were designed to do to see what they *can* do. And I think you know now well enough to learn from others, without it hurting your manhood. We are all tied together now, *nei?* It would be most helpful for you to solve this problem yourself for your self-respect and that of your crew. Their morale is tied to yours. So now you think and you think hard. Tomorrow, you tell me what you think. Halvorsen out."

"*Uf*. I think better morning," Per said, "good nights."

Learn from others, Halvorsen said. Tied together. Think hard. I inflated my mattress, removed everything but my shorts, and crawled into my bag without remembering that I had done so.

I thought. The Norwegians used tethers to give themselves gravity during the mission coast phase. Fuel transfer required acceleration—which was not necessarily thrust. Our ships were not built for rotating around each other on tethers. Where would one attach them? Impossible.

I did what I have done since a child to clear my mind. I prayed. Lord deliver me. Some call it a retreat to a fantasy world, a land of childhood faith in tooth fairies and Easter bunnies. If so, why is it still so strong in me, as other illusions have dropped away? That I do not know. But I do know the absence from here and now settles my mind.

An image came to my mind almost unbidden. I remembered watching the ships being hoisted up to their stations on top of the heavy lift vehicle. There were hard points in the noses where one could attach cables. Tethers. Just a little rotation would do for the fuel transfer, and, I thought, the system might be strong enough to give my crew some artificial gravity on the way back. I rolled out of the sack and headed for the terminals on the other side of the dome.

I found Ingrid still working, under red night-vision lighting, packing samples for the morning's departure at a flimsy looking bench opposite their tent. She wore shorts and a thin, dusty T-shirt. Not really understanding what was happening to me, I explained my idea with a breathlessness that had little to do with the mental effort.

"Not so difficult." She smiled. "We have spare tethers and hosing which we no longer need here."

The smile did it. She was lean, smooth, intense, glowing with health. She put a hand lightly on my arm. "Are you all right? You have been under much strain, I think."

God help me, I just put my arms around her, my head on her shoulder, and moaned. If I had done that at NASA, I would have been reported. But she made no objection. After a minute, she gave a slight low laugh, returned my hug, and rocked me back and forth like a child. Urgency overcame me. My hands found their way down her back and beneath the elastic of her shorts.

"Are you trying to seduce me?" She asked, in a voice that neither invited nor condemned, but seemed more in the tone of curiosity.

My men were wrapped in emergency blankets sleeping on the other side of the dome. Per was asleep in the tent. She could have yelled and destroyed me, humiliating me even beyond anything that had happened so far, I was that far out of line—and I could not help myself, not even for a moment.

But instead of acting offended, she stroked me gently, "I do not mind." she murmured. "Per is sometimes too polite." She knelt to the floor and I followed. Her kisses were light and motherly at first, then more and more passionate. And so we two responsible adults made love, then and there, as if we were teenagers in the back seat of a car.

All through it, she smiled at me as if I were a child she was indulging with a minor treat. And when it was over, I turned my head so that she would not see my tears. But she pressed my head to herself and held me again, as a mother would a child.

"This is nothing wrong," she murmured as my sobs turned into deep breaths. "We both needed it, so do not hate yourself for it. But now we must work on getting people back to Earth, yes?"

Six sleepless hours of calls to Mission Control later, our engineers had conceded that the remaining crews could have some gravity on the way back—with the *Leonov* and the *Zhang-Diaz* tethered nose to nose. Fortunately, the UN ships were launched as fuel tanks with their interiors fitted afterwards—they could be rearranged for spin gravity from inside and that would give their crews something to do. The thermal control people griped, the communications people griped, the propulsion people smiled.

And the numbers worked out, just. We would have to put everyone on the *Leonov* before the final Earth orbit capture burn, and discard the *Zhang-Diaz*, but my ship would have served its purpose as lifeboat and fuel tank by that time.

But the *Amundsen* and *Fram* were designed to go directly to Earth, on a faster trajectory. The easiest thing to do was to not try for a rendezvous, but rather for those of us on the surface to stay with the Norwegians. I relinquished my diminished command to Boris Yakov on *Leonov* and watched the ticklish tether and departure operations from the surface. This was my penance for my pride.

Three of my men lifted on the *Amundsen* with Ingrid while I and another lifted with Per on the *Fram*. We passed Phobos on the way out—the inner Martian moon would have to wait.

We tethered together without incident after trans-Earth insertion in an operation that turned out to be surprisingly simple. Per went outside and hooked the ships together while they were nosed up to each other. Each ship then translated to its own right while the line played out, and when the cable was mostly out, did a small burn at right angles to the tether to induce the rotation. Any swinging motions were damped with attitude control thrusters.

Despite six men and one woman, there were no struggles between people on the return mission. Its commander and her understanding first mate saw to that. The Norwegians had a little battery-powered tether runner that gripped the line like a set of tram wheels and pulled you from one ship to another. Ingrid made the trip once a week. We all had frequent times alone with her—and it was not necessarily for sex. People are made to come in pairs, I think, and there are times when it is comforting to be with a woman even if you do nothing but look at the stars, not even talk.

One night three weeks out from Mars, we found ourselves in the dome alone. Per and Mustaffa were asleep below. We sat side by side on one of the acceleration couches, touching comfortably—and uncomfortably. I was fighting a war with myself inside, and losing, again.

"Could you care for me, really?" I asked, meaning could you be the wife of a man who would protect you, who would not let you sleep with others, who would lead you instead of follow? "I think, at times, that I would undo everything to have you, and accept what fate that would bring."

To take another man's wife? To steal in the bed a share of the glory I could not win among the stars? No man with self-respect would do that, but events had stripped me to my essential needs. I could summon little sympathy for Per either; he seemed far too careless with his property.

Ingrid touched my lips with her fingers. "It could not be the same with you as with Per. He gives me the space I need and, in my way, I am unbreakably loyal to him. I enjoy doing things for people I care for, but not for life. I cannot be owned by anyone, and I think you want to own me."

Wanting what I cannot have is a way of life for me. It does not stop me from trying. I looked up at the *Amundsen*, far overhead on the other end of the tether. "Does it have a telescope?" I asked.

"Of course it does," she answered, "do you think they watch us now?" She smiled and waved at the distant ship. "Should we put on a show?"

I shook my head. "Ingrid, God forgive me, I want to love you, but to prove it you ask me to abandon my culture, my concepts of right and wrong that lie more deeply in my soul than any other. I am ashamed of myself."

"I am not ashamed of what I do not think is wrong." She smiled and added, "But I would not embarrass you. We can always turn out the lights, Enrico, so no one can see through the reflection."

I stared at her. "You knew."

"I know many things—like how to win a race to Mars, and how to run a happy ship."

"The maneuvers, the surprise separation. That wasn't Halvorsen's doing?"

"Was Halvorsen on this ship? Was it Halvorsen who had a personal stake in being first—oh, he had point to make, but, *nei*, it was not a point that required his being first. If anything he is somewhat upset with me." Her laugh was a throaty burble of delight. "No, that dear old man did not beat you to Mars. I did. I wanted to be first because I am a woman and I wanted to do something no one would ever forget, or put in second place. So I did it."

The look of complete shock on my face must have troubled even her. Good men had died—but did they die because of what she did, or because of what I did in response? And if she had not responded and it had happened anyway—I and five more would be dead.

"You must get used to this, I think." She caressed my chest and murmured, "It is not so hard to understand, is it? That no one owns me, that I, too, pursue my own goals and my own happiness?"

But it was hard. My mind was elsewhere, so lost in the maze of contingency that the only way out was to step out of the maze entirely through a greater dimension—that of providence. What happened, happened. It was not my fate to be first in anything—on Mars, or in the heart of the woman I must love, and hate, more than any other. Finally I took solace in how far from being last in all these things I was.

"I should die for this," I said before my lips met hers for what I vowed would be the last time. "Or you. I am not sure who."

I did not gain the reward of death during the aerocapture maneuver when the *Amundsen* reached Earth, and I had to endure the purgatory of weeks and months of impoliteness from the insatiable vampires of the media. I fled to southernmost Argentina. Per and Ingrid went to Mars twice more, and settled there in 2043.

I have not been into space again—no one has asked for me, and I have not tried. I will not tempt Providence again. Linda and I settled on a rancho near Río Gallegos. It is a cold, bitter land but suitable for cattle, horses, and grandchildren.

Over the years, with agonizing slowness, this sleazy badgering of the press has dribbled down to the point that I almost miss it, as one might miss the pain of an aching joint that becomes so familiar as to be part of one's personality. The fact of my being part of that first group to go to Mars has assumed more importance and the circumstances less and less.

And, in the bottom of a desk drawer among things my late wife never saw, I keep an old picture of Ingrid, clipped from one of those magazines whose photographers had caught Ingrid on the Riviera so many years ago. In shame, I look at it and remember. I look at it and wonder, is she our future? There are many like her in space these days, and some who see a biological aspect to these things point out that the mindset best for managing a spacecraft is very close to that of keeping a home.

I dare think now that my male-oriented values, my ideas of a paternal God, my beliefs of what men and women should be, may not fit out there as well as hers. Such beliefs may be of no more lasting consequence than those of the people who built the pyramids or crossed the Bering Strait. Save for these past few primitive centuries, Ingrid Karinsdatter's way of loving and living may be what most of eternity thinks of as typically human. Still, the pyramids are there. I salute their builders.

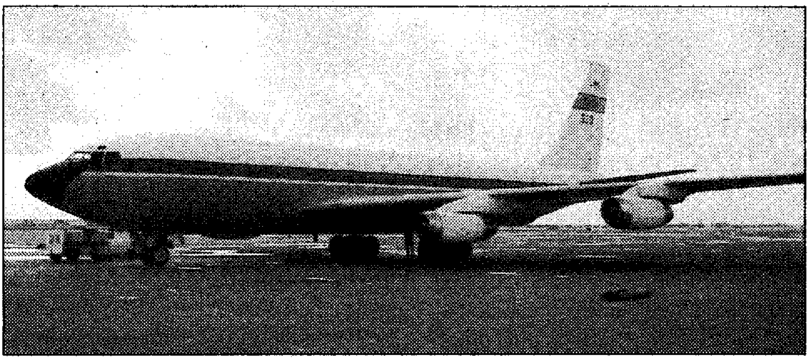
Looking back, the wonder may be not that a big, complicated, political, hierarchal UN/ISA mission was beaten to Mars by a woman, but that there was one at all.

Forgive me; but when I look on Ingrid, I still long for something. But it is not a body or a moment of illicit joy that time can never return that I covet as I contemplate the possibilities of eternity. No, it is not *her* that I covet. Not her so much as her freedom. ■

Special Feature

T. A. Chafin

MICRO-G AND ME



About fifteen minutes into the flight, the pilot signals that the plane is at altitude and you are permitted to leave your seat. You move through the cabin to your equipment and make sure it is securely strapped to the floor of the plane. The first warning sounds and you sit down on the padded floor of the plane, taking hold of a safety-strap. Almost immediately, the plane pulls into a two-to-three-*g* climb for about thirty seconds. The second warning sounds, the work lights come on and the plane noses over a little . . . then farther . . . and farther. That dropping feeling you get when your plane encounters an air pocket hits you and keeps getting worse. The fear of falling that seems to be ingrained in our racial memory reaches out and takes hold of your heart, but your brain tells you everything is fine. "Just because you're in a plane which is falling out of the sky like a rock is no reason to panic," it says, and you try to believe it. Suddenly, you notice the satchel you brought on board is floating above the cabin floor and you realize that when the flight supervisor told you to tape it down, he meant the entire bag and not just the strap.

You reach out and try to snag it, absentmindedly letting go of the safety strap. Before you can correct this mistake, you start to float above the padded floor yourself. Your equilibrium vanishes—up and down have disappeared. You think you're going to be sick. . . .

This is what it's like to fly in NASA's micro-gravity training aircraft, the KC-135. The plane, which is used mostly for training and experiments, is where our astronauts get a small taste of what they will experience later in space. Each flight consists of about twenty minutes of micro-gravity time in thirty second increments. Officially nicknamed "The Weightless Wonder," there is little doubt as to why it has unofficially been dubbed "The Vomit Comet" as twenty minutes is long enough to get "space sick," play, experiment, and truly enjoy this pleasant/miserable experience. (Yes, I got sick. I wouldn't have missed it for the world!) The exciting part of this story is this is something that anyone can experience! Herein lies the tale.

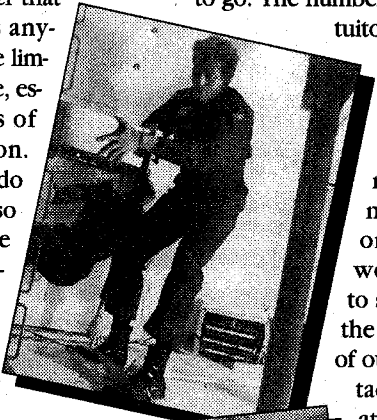
In 1985, my friend Rich Kolker and I were among the first adults to attend the United States Space Academy in Huntsville, Alabama. Over the next five years, we led a group of dedicated space enthusiasts to the Academy over half a dozen times. To date, Rich has attended more times than anyone else. (I think I'm in second place.)

As many of us were fans of *Star Trek,* we became known as the Enterprise Team. We were so well thought of that we were invited to help design the new 10-Day Adult Program. We were also the first team to attend the newly designed program.

Toward the end of the camp session, a NASA astronaut was invited to address us. Our lecturer was Byron Lichtenberg, a Space Shuttle Astronaut with two missions to his credit. During his talk, he spoke about a company in Boston, Massachusetts, called Payload Systems, which leased space on board the KC-135. He spoke about how space on board was leased to corporations and private institutions, such as colleges and universities, for scientific experiments. Several members of the Enterprise Team remarked how exciting it would be if private citizens could buy space. Byron reiterated that, currently, only corporations and private institutions could lease space. The price for one seat on board: $4,000.

Over the next few months, several members of the Enterprise Team thought about what Byron had said and we investigated the possibility that we could lease space on a flight. It was discovered that if we formed our own nonprofit corporation and met a few other requirements—pass a Class A Flight Physical, participate in a session in an altitude chamber, and provide an experiment—Payload Systems could permit us to lease space on the KC-135 and not violate their contract with NASA. We began to make plans.

Several of us lived in the Commonwealth of Virginia so, in order to meet the first of the requirements, we formed a nonprofit corporation in that state called Space Access, Inc. We had a board of directors (I was secretary) and a corporate charter that defined our goals as anything that forwards the limit of human knowledge, especially in the areas of science and education. This permitted us to do almost anything. It also permitted us to lease space on NASA's KC-135 as our charter fell within the limits defined by NASA's contract with Payload Systems.



Our next problem was to determine how many seats we wanted or, more correctly, figure out how many we could afford. When a seat is rented on the KC-135, you are permitted to fly on three successive days. Each day, the KC-135 flies a total of forty parabolas. Each parabola lasts one minute, half of which provides micro-g. Thus, your total micro-g time each day is twenty minutes, for a grand total of one hour of micro-g time. Not many people can afford to spend $4,000 on an activity like this. However, in an unprecedented move, Payload Systems decided that a different person could fly on each day. That meant the price dropped to about $1,350 with a total of twenty minutes of micro-g time for each person. With this new arrangement, we came up with a total of six people who wanted and could afford to go. The number of people was fortuitous as it had to be a multiple of three.

With our seats purchased, we needed an experiment of a scientific nature to perform on the flight as we were not permitted to simply go along for the fun of it. A couple of our participants contacted science clubs at their various alma maters and we presented them with the opportunity to design an experiment to be performed by us in micro-g. They came up with three experiments, of which the most exciting one involved fish in zero gravity. (You should see them panic when they try to swim through an air bubble in the middle of the water.)

With our seats paid for and our experiments prepared, we worked on meeting the rest of the flight's requirements. We were all required to pass a Class A Flight Physical given by a US Air Force Flight Surgeon. Finding a flight surgeon with an opening in his schedule was the biggest problem. The fact that we lived in various parts of the country didn't help either. However, we were able to make appointments at a few military bases around the country. Unfortunately, one of us failed for being fifteen pounds overweight. (That was myself.) You see, a Class A physical is the same one given to hotshot pilots who pull 9 *g* turns in high performance aircraft. When we explained why I needed the physical and that I wouldn't be pulling anything more than 3.5 gs, he was convinced to let me pass. (I could have kissed him.)

There was one more requirement we had to meet. It was necessary for us to take a course offered by the Air Force on the dangers of oxygen deprivation and fatigue during flight and then complete a session in an altitude chamber. Again, a nearby military base helped us over this last hurdle.

I could go into how we flew down to Houston, Texas, in a private plane and the other adventures we had on this trip, but I'm sure that isn't what you want to read about. The above details are how anyone with the patience, time, and money could have gotten up to an hour of micro-g time. Byron Lichtenberg and Rich Kolker worked together on this project in the hope of accomplishing two things—they wanted to show that others could do this as well, and to establish a precedent at Payload Systems which would permit them to allow other people like us to fly with them in the future.

However, there is now a way to experience the excitement of micro-gravity without having to go to all of the trouble we did. A commercial enterprise now exists that can supply the same experience. It is a joint venture of Weaver Aerospace and Interglobal Space Lines, Inc. They provide a couple of different courses which have gained the approval of such individuals as Apollo Astronaut Buzz Aldrin. The courses consist of several hours of ground training and a micro-gravity flight. They are available to anyone and the requirements are nowhere near as stringent as the ones we were required to meet. They only require that you pass a Class III FAA physical, pay, and show up for the class. If these courses had been available a decade ago we, the Enterprise Team, might have saved ourselves a great deal of trouble.

You can get further information by writing to: Interglobal Space Lines, P.O. Box 8947, Jackson, WY, 83001; calling (307) 739-1296; or faxing (307) 733-1391.

If you want to experience freefall, short of getting into a space program, this is the way to do it.

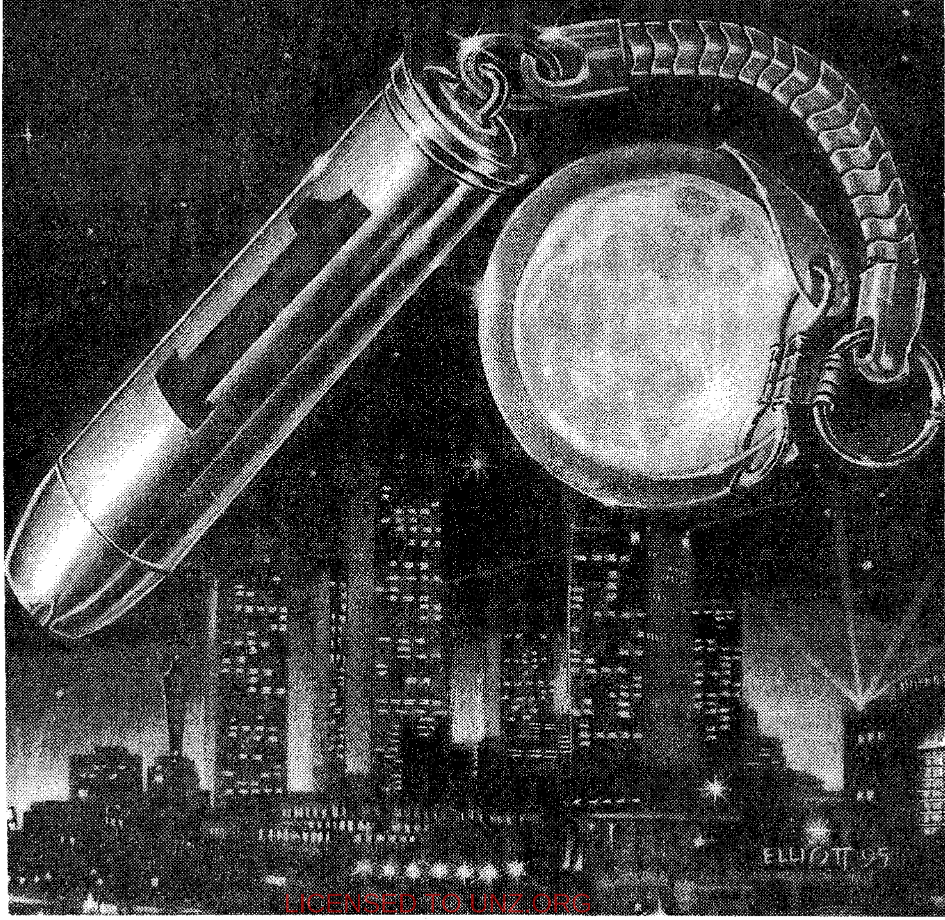
Anyone could have done this before we did. We were simply lucky enough to be the first and creative enough to believe we could. Just a case of being in the right place at the right time with the right people. ■

Barry B. Longyear

L.A. IN L.A.

Just how far does the "observer effect" go?

Illustration by Darryl Elliott



Lyle Bennet tried to hide his facial expression from Dr. Raeder by looking down at his notes. He needed a moment to think. Lyle had always envisioned himself as a future psychological explorer blazing new paths in the treatment of mental disorders. He had found himself, however, contemplating a master's thesis comparing the performances of two breeds of lab rats running a slight modification of the Hauser Maze. After hearing a description of the project, his thesis advisor had suggested he look for something else. That's what Lyle had thought even before the suggestion had been made, and that was what he was doing that morning in Dr. Raeder's office. But Raeder had to be kidding.

Lyle looked up from his notes, stifled a giggle, and leveled his gaze at his thesis advisor. "Let me get this straight, Dr. Raeder. You're telling me wolfmen are real? Silver bullets, full moons, bad hair days, and all that?"

Janos Raeder returned the gaze and didn't change expression as he tapped the tip of a freshly sharpened pencil against his desk blotter. Abruptly he tossed down the pencil, leaned forward in his chair, and clasped his hands in front of him, his wrists on the edge of his desk. "No, that is not what I said. What I said was that you should check out a meeting of that new twelve step program." He glanced at a sheet of paper on the desk. "Let's see. This is the thirty-first, right? Friday?"

"That's right."

Dr. Raeder moved a finger down the list. "Here it is. There's an L.A. meeting tonight on Alameda. I think you should at least go and check it out."

Lyle's eyebrows went up. "L.A.? Lycanthropics Anonymous? Werewolves, right?"

"Look, Lyle, you were the one who came to me for suggestions regarding a new thesis topic."

"Yeah, but werewolves? Give me a break."

Dr. Raeder slowly shook his head. "I don't know, Lyle. Perhaps I made a mistake. This is the kind of subject that, properly handled, could make your career take off from a standing start. Your mind seems a little too shut down, though, to take on a subject as radical and controversial as this."

Lyle held up his hands. "OK, look, I'm coming at this cold, Dr. Raeder. This is all new to me, as long as you ignore a bunch of bad Lon Chaney, Jr. movies that rotted out my mind years ago." He lowered his hands to his lap and tried to hold his face expressionless. "Why not let me hear the whole thing and then I'll decide."

His advisor took a pained breath then continued. "First, Lyle, forget all about Lon Chaney, Jr., silver bullets, full moon freakouts, and Hollywood horrors. Lycanthropy is a very real, quite painful, condition. I'm not only referring to the well-known psychotic belief in being an animal. The variation of lycanthropy to which I refer also manifests itself in physical symptoms, such as measurable increases in body and facial hair, dentition, bone mass, musculature, and alterations in saliva and blood chemistry. Are you familiar with Kuchilan's recent paper on hysteria?"

Lyle nodded. "Yes. Fanatics tapping into forces on the quantum level, miracle cures, religious freaks who go into a frenzy and begin squirting blood from their palms. But this—"

"This is the same sort of thing, Lyle," interrupted his advisor. Dr. Raeder held up a finger, nodded, and said, "Hold on. There's something I want you to see."

He got up from his desk, went to an old wooden filing cabinet in the corner of his cluttered office, and opened the middle drawer. "It's in here somewhere . . . here." He pulled out a thick accordion file that had obviously seen a lot of wear. Almost reverently the doctor placed the file on his desk, opened it, and began thumbing through the contents. "Yes." He pulled out a dog-eared eight-by-ten glossy print and handed it across the desk to Lyle. "Look at that."

Lyle took the print and frowned as he examined it. It was a print of six different stages in the transformation of a man, in his early twenties, into something very much resembling a latter-day Hollywood wolfman. In all six stages the man was clad in sixtyish hippie garb: headband, peasant shirt, patched flares, and sandals. In each stage there was a definite increase in body and facial hair, an elongation of the upper and lower mandibles into a shape resembling a muzzle, an incredible enlargement of the canine teeth, and a tongue that would be the envy of any Doberman. The increase in upper body mass had been sufficient to split open the baggy shirt's seams. On the final frame the enlarged hairy toes sticking out of the sandals each carried what looked to be a two-inch-long claw. Similar armaments graced the fingertips. Time and date signatures appeared on each of the frames. The date on all of the frames was 4 May 1967. The elapsed time indicated that the subject had made the transformation from young adult to drooling beast in just under three minutes. Lyle raised an eyebrow and handed back the print. "Jack Nicholson did it better in *Wolf*."

Ignoring the comment, Raeder took the glossy and tapped it with his finger. "The subject's name was Roger Westlake. He was a psych student at Pepperdine working on his master's. This series of shots was taken under faculty supervised laboratory conditions just before he was committed to Pescadero."

"*Was* Roger Westlake?"

"I beg your pardon?"

"You used the past tense, Doctor."

"Oh." Dr. Raeder nodded, his expression quite wooden. "He was reported dead in October of 'sixty-nine. The story was that he attacked some other patients and, in the process of subduing him, he was accidentally killed." Raeder held out a photocopy of a newspaper clipping. The headline read: "Three killed, eleven mauled at Pescadero."

Janos Raeder dropped the clipping back into the file. "Westlake's body was cremated before anyone could get a look at it. The two patients and the guard who were killed, however, looked as through they had been savaged by timber wolves." He looked up at nothing in particular. "They were all cremated, as well." He faced Lyle. "It might be very interesting to find out what happened to all of the patients who survived. The belief among most lycanthropics is that a virus in the saliva is what transmits the disease." Dr. Raeder tapped the glossy and said, "In any event, this is one of the most well documented modern cases of lycanthropic hysteria that exists."

Lyle gestured at the photo with his hand. "Look at that increase in body mass, doctor. All that has to come from somewhere, doesn't it? What'd he do, snack on an ox while they took the snapshots?"

Dr. Raeder looked up from the file and fixed Lyle with his eyes. "Here is a theory for you to consider: the quantum field is a Universe-wide matrix of energy and information. We are all parts of this matrix and you cannot alter any part of it without altering every other part in some manner. Changing or reinforcing a thought pattern is just such an alteration. The upshot of this is that if you believe strongly enough, your body will use every power available to it within the field to fulfill that belief. Energy convertible into mass can be drawn from the field. Are you familiar with the works of Deepak Chopra?"

"No."

"In just one of his works, *Ageless Body, Timeless Mind,* he shows how one's intentions can affect the quantum field such that an individual can increase or even reverse aging. Imagine the physiological changes—"

"Is this the guy who was on 'Oprah Winfrey' some time back? I'm supposed to take pop science seriously?"

"No. As a scientist, Lyle, I expect you to investigate first, and only then form your conclusions."

"Sorry."

Janos Raeder brushed away the apology and the question with a wave of his hand. "It doesn't matter. Look, Lyle, there are the miracle cures from terminal diseases you mentioned, and the stigmata, what you called those freaks squirting blood from their palms. Think about the very real cases of stigmata we have on record. These cases are similar to lycanthropy in that they involve actual hysterical alteration of fluids and tissues simply on the basis of a very intense belief." He tapped the print once more. "And this. It is a very real, very painful, and quite debilitating condition. It can't be cured, as far as we know, but it can be arrested, much like compulsive gambling or alcoholism."

Lyle clasped his hands over his belly and slumped down in his chair. "I'm familiar with the cases. In fact, I'm pretty familiar with all of the literature on hysteria, and I've never run across anything like werewolves."

Dr. Raeder pursed his lips, placed the glossy on top of his desk and dropped into his chair. "I'll tell you why, Lyle. It's for the same reason you're dragging your anchor right now. Just as no one would take alcoholism and addiction seriously as diseases back in the thirties, lycanthropic hysteria has been passed off as a moral problem, or hoax, for almost eighty years. That's why this study, almost thirty years old, wasn't taken seriously. It was never published and little new work has been done in the field. There is simply no grant money available for research in this field. But just as those who wanted to recover from alcoholism back in the thirties put together their own therapy program in the form of Alcoholics Anonymous, thereby pioneering the treatments for a host of compulsive disorders, those who want to recover from lycanthropy are doing the same. I think the field is ready for a courageous new look at this problem." He shrugged and held out his hands. "If you want a new thesis topic, it's the best suggestion I've got in the shop. It will be new work and much more impressive than another herd of tired rats running through yet another maze."

Lyle twiddled his thumbs for a moment, then leaned forward and held out a hand. "Could I look at that photo once more?"

Dr. Raeder allowed himself a slight smile. "By the way, Lyle, if you decide to go to the meeting, don't make a point out of your being free of this condition. Also, don't take any notes or bring a recorder. They are adamant about their anonymity, and for very good reasons. Finally, don't call them wolfmen or werewolves. Call them lycanthropics. They are quite touchy about that."

"What time is the meeting?"

"Eleven-thirty at night."

"That late?"

Janos Raeder's eyebrows went up. "You're kidding. Midnight is the toughest time for lycanthropics. If nothing else, Lyle, this experience will be an excellent opportunity to raise your consciousness regarding the plight of a much neglected minority."

There was plenty of time before the meeting, and, after an uninspired taco at the student center, Lyle put in a few hours at the university library. First he tackled the subject of stigmatization with examples beginning with Francis of Assisi in 1224 to Louise Lateau in 1868. The latter was a peasant girl whose case was investigated by Professor Lefebvre of Louvain. The girl's "Christ wounds" began on April 24th, 1868 and bled regularly every Friday thereafter. The ability of the human organism to alter its tissues radically through intense belief was well established. What was not so well established was a degree of alteration sufficient to turn a human into a completely different species.

Search as he might, his pursuit of a work on quantum physics for dummies was fruitless. The only works available were either dripping with equations or too general to discuss the application in which he was interested. Reluctantly he resorted to pulling Chopra's *Ageless Body, Timeless Mind* from the shelf and paged through it. The thesis seemed to be that every cell of an individual's body is constantly listening to what that individual is telling it. If you tell yourself "I'm too old for that kind of stuff," the cells listen and you become "too old for that kind of stuff." By the same token, if you decide to become more youthful, the cells listen and can actually reverse the aging process. Chopra wrote:

"You can control the informational content of the quantum field. Although there is a certain amount of fixed information in the atoms of food, air, and water that make up each cell, the power to transform that information is subject to free will."

Lyle leaned back and scratched his head as he recalled the photograph Dr. Raeder had shown him. As scientists looked on, Roger Westlake supposedly just stood there, turned into a werewolf, and almost doubled his body mass in the process. All of that bone and tissue had to come from somewhere. By changing the informational content of the quantum field, would it be possible to convert that energy directly into mass? Several primitive cultures had shape-shifter traditions: men and women who turn themselves into snakes, eagles, bears, even wolves. Lyle leaned over the keyboard and began to tackle the subject of lycanthropy.

The computer subject search was not sympathetic to the term "lycanthropy." The prompt insisted that if Lyle wanted to pursue the topic, "werewolves" was the term to use. The pickings seemed slim. Douglas's *The Beast Within,* was filed under "Animals, mythical." An 1865 work, Baring-Gould's *The Book of Werewolves,* revealed its thesis in its subtitle: *An account of a terrible superstition.* Then Lyle's eye was caught by another title: *A Lycanthropy Reader: werewolves in western culture.* Published in obscurity in 1986 by the Syracuse University Press, the work was described as "Medical cases, diagnoses, descriptions; trial records, historical accounts, sightings; philosophical and theological approaches to metamorphosis; critical essays on lycanthropy—" He looked up at the availability code and the *Reader* was out.

His eyes next turned to a 1937 work published in Paris by psychiatrist Jean Riendeau, English translation by Paul Norgren: *The Hidden Face of Jeorg Brandt: a case study of a lycanthropic.* The work was described as a three-year study of an unemployed Swiss laborer whose metamorphosis from man to werewolf was witnessed no less than nine times by Riendeau, four such times under confinement in laboratory conditions with corroborating witnesses. The volume was available.

It was a thin book, the embossed printing on its cover faded and gray, the pages inside edged with yellow. Lyle scanned the table of contents, skipped the background material, and turned to the first of the laboratory controlled observations of Jeorg Brandt's changing. Riendeau wrote:

"Jeorg was caged at his own request. The metamorphosis began shortly after midnight with Jeorg coming 'alive' from his usual deep depression, his increased animation followed first by the change of his eye color from blue to reddish black. His chest, normally at 120cm, showed 151cm on the tape before Jeorg swatted Dr. Bresette away from the bars where my colleague was taking the measurement. I saw the front of Bresette's laboratory coat slashed to ribbons and turned back to see that Jeorg's claws were already half-formed, his muzzle filled with horrendous teeth. . . ."

Here it was again: energy consuming transformation, incredible increase in body mass, with no apparent source. Or, as Riendeau put it, "He seemed to draw upon the thin air for material," although when the change was complete, Jeorg Brandt wolfed down 24kg of raw beef before he exhausted himself trying to get out of his cage and fell asleep. Later, as himself, Jeorg was horrified after reading the reports and seeing the photographs. It was after the fourth of these laboratory episodes that Riendeau's subject committed suicide, unfortunately in full human form.

In the translator's introduction, Paul Norgren described how the publication of *The Hidden Face* had destroyed Riendeau's reputation as well as the reputations of the four colleagues who had participated in the study. Lyle checked his watch and realized that he had just enough time to make it to the meeting. He frowned as he realized that on some strange level he was just a little bit frightened.

"My name is Ted and Ah'm a gr-r-rateful recoverin' lycanthropic."

"Hi, Ted!" answered the twenty or so men and women seated in the conference room on the ground floor of an otherwise locked up office building. As Lyle examined the faces seated in the circle, he was uneasy. Everyone in there looked just like regular humans. Minority representation, old, young, male, female, neckties and tie-dyes. What made him uneasy was that everyone in the room, with the sole exception of himself, believed him or herself to be a werewolf.

The one called Ted cleared his throat, which sounded a bit like a growl to Lyle, then he smiled and said, "Welcome all tew the Hair of the Dog Group of Lycanthropics Anonymous." Ted spoke with just a touch of Scottish brogue. "We'll all open the meetin' with a moment of silence followed by the Serenity Prayer."

During the moment of silence Lyle swore that the young lady sitting to his right was panting while a young man sitting on the opposite side of the circle was scratching behind his ear, although only with a finger. Lyle started having an almost uncontrollable urge to laugh out loud. His defenses began crumbling when he heard someone to his far left sniffing. He didn't look. Lyle believed that if he caught a glimpse of one of them sniffing the butt of another, he would lose it altogether. Just thinking about the possible flea problem made tears come to his eyes, and he covered his face hoping that at the worst he might look like he was crying.

While they recited the Serenity Prayer (God, grant me the serenity to accept the things I cannot change, courage to change the things I can, and wisdom to know the difference), Lyle felt a friendly hand (paw?) petting the back of his head. He thought he would pop an artery and he decided that he would have to leave the meeting. Before he could go into action, however, the man chairing the meeting began speaking again.

"This is a special anniversary meetin'

tonight. Allyson is celebratin' one whole year without turnin'." Loud applause followed Ted's remarks accompanied by some whistling and some rather distinct howling. The woman to Lyle's right seemed to have increased her panting. Lyle noted that her tongue wasn't hanging out. He wondered if her real problem was asthma.

"Allyson will be our speaker for the first part of the meetin'," Ted announced, "then after the break we'll have our sharin' session. Before we get started, are there any newcomers to the group?"

One hand went up. It was a man of about thirty-five with wads of shaggy black chest hair showing above the neck of his faded red T-shirt. He had an underbite like a steam shovel. "I'm Waldo," he almost growled. "I'm a recovering lycanthropic. I just got out of treatment and this is my first meeting."

A round of welcomes greeted Waldo, then a few faces turned in Lyle's direction. Lyle shrugged to hide his embarrassment and grinned as he held up his hand. "I'm Lyle and I'm just new here."

"Hi, Lyle," greeted the group. "Welcome."

Red-faced, Lyle managed to nod in return as he lowered his hand to his lap and focused his gaze on the floor in the center of the circle of chairs. Two latecomers entered and took their places in the chairs to Lyle's far left. As Ted resumed the program by having members of the circle read the Steps and Traditions of L.A., the woman to Lyle's right whispered to him, "Too bad. It looks as though Ralph went out again."

Lyle turned and looked at the two latecomers. One was a very normal looking business type dressed in a tan three-piece suit. The other one looked like a nightmare. He was built like a short power lifter with upper arms like thighs, and thighs like sides of beef. His clothing consisted of a torn and dirty pair of triple extra large gray sweats and a pair of black shower clogs. His hands and feet both were knobby and twisted, while his lower jaw jutted out from his face so far that it appeared to be an effort for the man to keep his lips closed over his teeth. His hair was trimmed into a burr cut, and he appeared to have no body hair at all. Little bloody pieces of toilet paper on his face and the backs of his feet and hands were the aftermath of what appeared to have been a marathon encounter with a razor. His nose was sharply upturned and powdered to a light gray. Lyle watched Ralph until the man absentmindedly allowed his mouth to fall open revealing a set of tearing teeth that looked capable of biting through a picnic ham with a single snap. The expression on Ralph's face was one of deep shame.

Just as Lyle turned to ask the woman to his right what she meant about Ralph going out, Ted called out from the podium, "Verra well, let's hear from Allyson now. Come oop, lass!"

Accompanied by thunderous applause and howling, the woman who had been seated to Lyle's right stood, and with a face glowing with excitement, her diminutive form replaced Ted at the podium. Ted took his place in a chair to her right. As the applause and howling died down to a few whimpers, Allyson looked down at Ted and said, "It's OK to call me lass, Ted. Just don't call me Lassie!"

Based on the subdued chuckle coming from the circle, Lyle presumed that it was a well worn joke in the group. It was new to him, however, and he laughed out loud. Allyson faced the circle, smiled, and said, "My name is Allyson. I'm a recovering lycanthropic."

"Hi, Allyson," answered the circle, including Lyle.

She shrugged her small shoulders and looked down at the podium for a moment. "I guess I'm a little nervous," she confessed. She pushed the bobbed blond hair back from her forehead and aimed her pale blue eyes at the faces in the circle. "I never thought I'd see this night," she said quietly. "Fourteen months ago I was locked up in a mental ward with three charges of murder pending against me." She fixed her gaze on the one called Ralph. "The medical records from there show I weighed 307 pounds, and not an ounce of it was fat. I was covered with coarse blond hair; I had teeth that could, and did, chew through a solid oak door; I had claws and paws; and I had ears like Mr. Spock." A quick laugh ran around the circle.

Allyson's eyes glistened as she said, "And now I am a free human being. I haven't turned for a whole year. It is such a miracle." As the woman paused to get control of her tears of gratitude, Lyle found himself curiously touched. Perhaps he looked upon the whole issue with skepticism, but he certainly believed that *they* believed.

Lyle glanced to his left at the one called Ralph and saw the huge man sobbing into his shaved paws. Taking a second look at those paws, Lyle noticed that the claws had been trimmed very short. From the thickness of the claws it must have been done with bolt cutters.

Now in control of herself, Allyson continued. "As it did for many of us, it began for me by being bitten by an infected family member." She held up her hands. "Now, I know that some of you have therapists who say lycanthropy is not an infectious disease at all, but is, instead, a form of hysteria, and I respect that. Speaking just for myself, though, there are lots and lots of sisters in this world who are bitten by their younger brothers who don't become beasts ravaging and terrorizing the countryside."

Several spontaneous growls of enraged agreement erupted from the circle. Lyle noticed Ralph looking angrily at the floor between his feet as his massive head nodded. His lower fangs were visible. Lyle studied the man, trying to see if Ralph had made himself up to look that way, but all of the evidence suggested that he was almost a werewolf trying very much to look like a human. Suddenly Ralph glanced at Lyle and Lyle averted his eyes and concentrated his attention on the speaker.

"I was nine when my brother bit me," said Allyson. "He was seven. He'd been a little strange ever since a huge dog bit him when our family was camping in Maine that one summer when he was five. He had the disease, of course, but I'd never seen him turn so I didn't know what was going on. I just thought he was being a little brother." After a sympathetic chuckle from the circle, Allyson bowed her head and became quite melancholy. "In fact I'd never seen him turn until I was brought in to identify his body four years ago. He had been killed while attacking someone who was armed. Until he died my brother hid his disease from all of us. Of course, it wasn't any big accomplishment to hide it from me. By then I was, as we say in L.A., up to my own knees in fleas.

"It was about three months after my brother bit me, almost on my tenth birthday, when I turned for the first time. It was after fourth grade gym in the shower room. I'd been feeling sick all day and had been excused from gym early. While I was by myself in the shower, it happened. The bone pain, the stretching of my skin, all of the awful hair. It hurt and surprised me so much I screamed. The janitor heard me and came running in. By then I was fully turned and I—I mean, he was the first—you know—what for legal reasons we're supposed to keep just between us and our sponsors." Again Allyson paused to control her tears while Lyle struggled with what she had said. Did she mean she had offed the janitor? Her next words gave him chills.

"After I cleaned up the mess I looked at myself in the mirror, the taste still in my mouth. You all know how it felt." Ralph and the newcomer, Waldo, grunted violently while the rest raised their eyebrows and nodded. "I had never felt so strong, so alive. I crawled in among the steam pipes down in the furnace room and slept off the first of many, many binges."

Ted stood and whispered something to Allyson. She nodded in return and looked back at the circle, a note of embarrassment in her voice. "It's just been pointed out to me that my words might cause some of you to want to go out again, and forgive me if I've called up any euphoric memories."

Lyle glanced to his left and saw a string of drool dribbling from Ralph's open mouth. The backs of his hands appeared to have gotten a shade darker. Waldo had his arms wrapped around himself and appeared to be holding on very tightly. When Allyson resumed her talk she concentrated on all of the horrors of a young girl, sensitive about her appearance and desperate to make friends and be popular, afflicted with a disease that would, without notice, turn her into a hideous creature that craved human flesh. She talked about when her parents found out and pulled her out of school. From then until she was seventeen she was kept under lock and key. Shortly after her seventeenth birthday the police found her parents dead, their throats torn out, the barred windowless room where she had been kept, empty.

By day she took classes and worked at odd jobs until she graduated into a well-paying position as a paralegal. By night she moved through the shadows of the inner city, seeking prey. On one of her nightly prowls she was taken down by officers from the University Division, L.A.P.D. They were assisted by a wildlife expert with a tranquilizer gun.

"They didn't know what to do with me at the mental hospital where I had been sent to assess if I was competent to stand trial. One of the orderlies there asked me if I wanted help, and when I said yes, he was the one who called Lycanthropics Anonymous." She glanced at the fellow who chaired the meeting, then to her left at a smartly-dressed woman in her sixties.

"Ted and Margie were the ones who showed up for me. They told me their stories and met with me almost every day, teaching me how to share and work the program. That was when I stopped turning for the first time. I'd go back after a few days, but my periods out were shorter and shorter. By the time experts on lycanthropy filed a brief with the court and the charges against me were dismissed, I hadn't turned for six days and that was three hundred and fifty-nine days ago. This was the first meeting I went to after getting out of treatment, I asked Margie to be my sponsor, and she took me to meetings all over L.A. until I could trust myself out at night alone. It's been a miracle for me and I never want to go back to what I was before. Thank you for letting me share."

Applause and howls erupted from the circle, Lyle clapping along with the others. As the applause continued, Margie stood, presented Allyson with something, then gave her a big hug. Allyson returned to her seat and Ted took over the podium. "Verra well, people, it's time for our break. Coffee, donuts, and the rest are in the refreshment area, and we'll pick this up again at midnight."

As some of the members headed for the kitchen and a few others headed outside for a smoke, Lyle leaned forward in his chair and rested his elbows on his knees. He couldn't make up his mind. Should he be afraid or fascinated? This was certainly a great subject of study for a thesis, but Ralph frightened him. So did Waldo. Everyone else seemed all right, but it was such a bizarre affliction.

"Having a tough time making up your mind?" He turned to his right and Allyson was smiling at him.

Lyle shrugged and said, "Congratulations on the year."

"Thanks."

He nodded toward her hand. "What did you get?"

She opened her hand revealing a key chain. Hanging from the chain through a hole in its base was a silver bullet marked with the numeral 1. "The program group gives these things out for anniversaries. I guess it's a bit of a joke." She held out her hand. "I'm Allyson."

"I know." Lyle shook hands with her. "My name's Lyle. Did that guy Ted say there's coffee out there?"

Allyson nodded. "Coffee, tea, donuts, a little burger—"

"Burger?"

Allyson nodded and lowered her voice. "You know, ground beef. In case a newcomer starts freaking. A little raw burger can sometimes help bring them down."

Lyle stared at her for a moment and was about to say "you're kidding," when there was a loud noise from the direction of the kitchen. He looked at the door leading to the kitchen as he got to his feet. "What in the hell was that?" One of the members peeked out of the kitchen door and said to all those left in the room, "Ralph's in trouble. Get Ben. I think he's out front having a smoke."

"I'll do it," said Lyle. Turning to Allyson, her back was toward him. He placed a hand on her shoulder and asked, "Is Ben the guy Ralph came in with?"

Before she could answer there was a crash from the kitchen, then a long mournful howl which was immediately followed by Ralph bellowing out, "To hell with the damned beef burger! Out there is live meat! He was staring at me like I was some kind of thing. *Live meat!"*

"He's right," came Waldo's voice. "That guy, Lyle! He's not one of us! He's meat!"

His hand still on Allyson's shoulder, he looked at the back of her head and whispered, "What—what should I do?"

She turned her head to the right, looked down at Lyle's fingers grasping her shoulder, and then bit them. "Ow!" He pulled back his arm, looked at his hand, and sucked on the side of his fingers where Allyson had bitten him. The skin wasn't broken, but it hurt like the dickens. "What in the—"

She turned and looked at him with blood-red eyes. She then smiled displaying gleaming white fangs that seemed to grow before his eyes. He bolted and ran screaming into the night.

"Allyson?"

She faced the kitchen door, removed her false fangs and faced Dr. Raeder. "You people were too slow. He ran before anyone could shout 'April fool.' "

Janos Raeder dropped his Waldo mask and makeup on one of the chairs and said between gasps of laughter, "You mean he still doesn't know? Hey, everybody, Lyle still doesn't know. He's probably calling the police right now."

Ben and his two smoking companions came in from the front. "Hey, what gives? Lyle or someone was supposed to come and get me to sit on Ralph, right? I just saw Lyle going ninety plus across Alameda. He's lucky he wasn't killed."

The laughter died down as Ben's comment sobered them a bit. Allyson cocked her head to one side and said, "It's my fault. I got a little deep into the part and bit his hand."

"You *bit* his hand?" demanded Dr. Raeder.

"Just a little nip. I didn't draw blood or anything with these rubber teeth."

They all stood in silence for a moment, then one of them made a rude sound by letting the air out of his pneumatic muscles. They all broke down and laughed as they howled and began removing their makeup. It was the best psych department April fool's prank ever.

Out of breath, Lyle leaned his back against the alley wall and gulped air. After only a few seconds, he looked around the corner and saw that the street was empty. "Oh, god," he gasped. "Oh, god."

There was a tightness in his chest and shoulders, and he pushed away from the wall to shake it out. As he crossed his arms in front of him, he could hear the seam on the back of his shirt split. He looked down and watched in horror as the hair on the backs of his arms lengthened.

"What? Oh, god! No! It couldn't—"

He shook his head as he thought at panic speed. That woman, Allyson, had bitten him, but she hadn't broken the skin. How—

He looked down at the hand that Allyson had bitten, hair already covering the spot, skin a darkening purple in the dim alley light, the nails already beginning their metamorphosis to claws. She hadn't broken the skin, but he had sucked on his hand immediately afterward.

"The saliva! Omigod! The saliva!"

The sleeve seams split one after another and Lyle felt himself filled with savage power, physical strength beyond anything he could have ever imagined, cravings and lusts that seemed to blot out portions of his awareness. His chest expanded as his thighs and upper arms thickened. He lifted his clawed hands and felt the shape of a muzzle erupting from his face.

"Hey, who's that? Look here, Pauly."

A young man with a blue printed bandanna covering his curly black hair stood in the alley entrance, his face hidden by shadows cast by the street lights. Lyle saw him and felt an eerie heat fill his chest as his heart pumped energy to his growing musculature.

"What you got here?" said the one called Pauly. He carried a wicked looking stiletto in his hand.

As the pair advanced on him, Lyle could see his immediate future very clearly. It would involve a lot of late nights, demands, and sacrifices that would probably savage his grade point average, but there was the excitement, the high, the incredible thrill waiting for him. Now he knew why Ralph had been drooling as Allyson related her war stories at the meeting. It was, Lyle knew, the first step on a walk through hell. It was a journey, however, that would not be denied.

Deep within his soul there remained a tiny human spark that spoke to him with fear. Perhaps there would come a time when the pain of the night hunt would exceed the sick thrill and excitement. Possibly then, when enough was enough, he would want help from those people at Lycanthropics Anonymous. He nodded his shaggy head as he felt the drool fall on the backs of his bristly paws. As soon as he was finished with Pauly and his friend, he'd have to go to Dr. Raeder's home and get his copy of the meeting list. He'd have to go to Dr. Raeder's house in any event. He could already tell that the pair facing him in the alley would never be enough. ■

State of the Art

Christopher McKitterick

CALL TO ARMS

Crusading for Tomorrow Beneath the SF Banner Today (Or, How You Can Save the World, Build Utopias, Make Children Smarter, and Maybe Plant a Few Trees)

THE PROBLEM; THE SOLUTION Science fiction's readers take the long view. We picture the human animal as part of a species whose skin is multicolored, whose voice is multilingual, whose home is multinational, whose future is unified. On the other hand, traditional culture—usually in power and defensive of the status quo—often sees borders and tongues and hues as signs of difference. To the status quo, difference is dangerous, and so is the future, because tomorrow's world will, without doubt, be different from today's. Long-term change is the most threatening of all.

By shunning creative uses of technology, by failing to seize opportunities (that might give us solar power or daily life on the asteroids), by imposing yesterday's values and traditions where they are inappropriate—on the future—traditional culture betrays our children's children.

Tomorrow as utopia faces an even greater bugaboo. Today, we bear the crushing weight of our past forays into violence against ourselves and our world, the legacy our fathers and our fathers' fathers ad infinitum left us. People need to unshackle themselves from fears imposed by tradition and think like SF readers in their everyday affairs. That is, people need to use the illumination provided by their rational minds *and* creativity to light the rough, branching path to tomorrow. Science fiction does this best by removing fear of the future, the unknown, and the other, and filling that vacuum with visions.

True, not much of today's SF is bursting with *hopeful* visions, though the balance is not necessarily *un*hopeful. But even someone reading a dystopic story about the year 2197 is reading something that assumes humans have, at least, survived until 2197—no small feat. In addition, reading a dystopic tale might prod someone to say, "Dammit! I won't let that happen. What can I do?" David Brin says SF's basic assumption is "that children *can* learn from the mistakes of their parents. Not that they always *do*." (From notes to the author)

There is something we can do, and it involves leading every possible young person into the fold of SF and SF-thinking. More on one way to do that a little later.

THE SCIENCE FICTION MENTALITY

"If the scientists have the future in their bones, then the traditional culture responds by wishing that the future did not exist."

That's C.P. Snow, from his "The Two Cultures" lecture. Here, Snow touches on the danger of allowing traditional culture alone to mold children, in effect, ignoring SF's messages and warnings. The hope of unlimited frontiers, of lands where humans can grow and prosper, is what gives our species its vigor. What kind of future lies in wait for a species so pessimistic and irrational?

This is why mainstream culture has such an anemic view of the future. Traditional thought tends to assume the future will be like the past, and new problems can only be solved using old solutions. However, SF thought is forward-looking, and even its dystopias show creativity—SF is unafraid to see every possibility, grand or gutter. As functional art, SF helps men and women dream great dreams—and recognize great nightmares before they happen, so they can be stopped.

So what gives today's youth dreams of a positive future? Can they hope to become spacemen, spreading human seed throughout the stars? Humanity has a long way to go, many obstacles to cross on its dimly illuminated path into the future. James Gunn has this to say:

> *I don't have a great deal of confidence in that future because there are so many things that could go wrong—a final war, a natural catastrophe, a major depression, or, most of all, a terminal energy shortage that would drop the level of our technological civilization below the point necessary to support space colonization. Perhaps most important is a failure of will, a loss of faith in human possibilities, a disappearance of the spirit to take risks, to adventure, that sent the Pilgrims west across the Atlantic and the pioneers west across this continent.* (Inside Science Fiction *132*)

Clearly, humanity faces a crisis. One need only watch the nightly news or take a close look at the world's cities. The need to orchestrate change is urgent. Science fiction readers must spread the SF way of thought because SF offers choices and alternative futures; it encourages the adventurous spirit and faith in human ingenuity. At the same time it provides excitement and an escape from a life that sometimes feels unendurable, SF replaces despair with dreams and offers—or at least illuminates—hope.

Even if tomorrow is bad, Harlan Ellison has said, at least there will *be* a tomorrow, and if there is a tomorrow, there will be one after that—and then tomorrow's inhabitants will have the opportunity to change tomorrow's tomorrow.

> *[W]e should dream great dreams and plan great deeds. What we do in this world is not always for ourselves. Occasionally—not often enough, to be sure—we think of others, of our children or our grandchildren or the children of the species to which we belong.* We should do one magnificent thing for them every generation. (*Gunn,* ISF *132, my emphasis*)

That last sentence remains brightly framed in my mind. This is why I'm writing, and why I hope you will join me in doing one thing—one thing which may very well give today's youth the tools to do a magnificent thing. And, having been part of that process, we will have participated in a magnificent thing, as the woman who tightens a bolt on a rocket booster's fuel pump is part of the Lunar Colony's great discoveries.

TOMORROW—WHAT YOU CAN DO

H.G. Wells, from his 1902 speech, "The Discovery of the Future":

> *All this world is heavy with the promise of greater things, and a day will come, one day in the succession of days, when beings who are now latent in our thoughts and hidden in our loins, shall stand upon this Earth as one stands upon a footstool and shall laugh and reach out their hands amidst the stars.*

We *can* stimulate the SF mind that dwells within all humans, our natural expression once we rid ourselves of the past's poisons, of the heavy and obsolete traditions that weigh us down and make us fearful of the magnificence that sleeps hidden in the blankets of tomorrow. Because SF takes us to the future, tomorrow is no longer the unknown. It is the place where dreams come true.

So we must reach out our hands toward the future, toward the youth of today who will be the policy-makers of that approaching time. In our hands we must bear the literature of enlightenment, a searchlight to show us glimpses of the hazy future. Today's youth must pick up that light and use it to illuminate the problems hidden in today's shadows. Dark ages fall unexpectedly, yet can last eternally.

A MODEST PROPOSAL

I won't suggest we eat the children of mundanes. Nor should we even eat the mundanes. Chances are, we would be destroyed soon after the first banquet.

SF fandom possesses a vast, untapped potential. You, who count yourself among its numbers, already know this and may even be frustrated. Perhaps you wish you could do something to save the world, but you haven't yet invented a replicator or sustainable fusion reactor. So what can we do? Certainly, a group of people who consider their brains their most important feature can do *something.*

I propose something very simple, that could be put fully into effect in days. It would cost virtually nothing, require very little effort (or as much as you are willing), and reap great rewards: Picture a future where spaceship exhausts seam the sky, their miniature stars reflected off the gleaming domes of cities-as-utopias, clean water flowing through rivers that link the cities, and cheap, safe power for everyone; the planets invisible to the eye but metaphorically in our societal backyard. The whole race cooperates on building all this—indeed, it never would have happened without that cooperation. The stars lie nearly within our grasp as mighty interstellar craft fuel up near Jupiter. . . .

How? Here's a start:

1) Local fan groups (or individuals) collect used SF magazines and books. Hey, the used bookstore only pays a few thin dimes! Perhaps we could also convince publishers to donate their hardcover returns—or, better still—convince magazine and softcover distributors to change their system of returns: Instead of taking covers, they might donate boxes of complete copies. They could leave the returns at the bookstores, saving costs as well as keeping precious SF from winding up in landfills. Our troops would take a little time out each month to march to the bookstores and pick up leftovers. (Experiments will prove the best methods.)

2) Sort (as much as is reasonable) into age groups: SF suitable for children, SF suitable for adolescents. Be careful about sex and language, since many non-SF people are uptight in these arenas. But do not censor, since the idea here is to *cause change,* to subvert what is wrong with today's world.

3) Pick someone from your group who is diplomatic and can speak the language of the mainstream. Remember that many of us scare those most conservative, and we will be dealing in large part with people entrenched in institutions: e.g., conservatives. But also remember that most teachers—at least the young ones—desire change and wish to have a part and place in it.

4) Contact local schools, libraries, and/or youth organizations and tell them you are willing to set up an SF distribution time/place—likely they will be pleased, since any reading is an improvement for many kids these days. Ask about procedures, what's allowed, etc. Talk with people you know in these organizations until you find someone fired up about saving the world. (A fan would be most excellent.) I suggest working through institutions because they are where we'll find concentrations of young minds.

5) *Regularly* provide kids with SF. If you or your group can't *give* them SF, help them select good library books.

6) Discuss their readings and ideas, informally, perhaps wherever the fan group meets. Schools or youth clubs might reserve a room for this. Don't talk down to them—remember how adult you felt at their age. Also remember that these are the people who will run the world in a few short years.

7) If you're willing to spend the time, be the kind of mentor you wish you had had then. Just meeting with a boy or girl once or twice a month to talk about the exciting ideas s/he discovered will stamp her/him indelibly.

8) Adopt a junior high school teacher or librarian. Be willing to speak to his/her class or help get speakers—SF-fan scientists can answer detailed questions related to readings and help kids generate ideas, and local SF authors give the fiction a face while helping it come alive.

Because SF requires knowledge of certain things to get the most out of the work, it prompts its readers to seek out more information. . . . Say, doesn't that sound familiar? This is what our schools are supposed to do.

Remember, most of us were first consumed with the idea-fire SF provides while still young, usually between 10-16 years old: *"As is the way with addictions, this one is mostly contracted in adolescence or not at all,"* writes Kingsley Amis (*New Maps of Hell* 246). And keep in mind "*we have a* selfish *reason to recruit. The average age of SF readers is growing older!"* (Brin, notes)

We must do one magnificent thing for the children of our species every generation, else we risk slow or fast extinction. Will tomorrow's adults be capable of doing something magnificent for their children, even imagining it? Or will they simply continue to ensure the downfall of our civilization and ecosystem? We can teach them to use the tools of SF to unshackle themselves from burdensome legacies.

It is up to us, today, to ensure tomorrow.

wait. . . .

Do you have more (or better) ideas? Comments? Would you like support or rapport in starting a program to Save the World Through Science Fiction? Write me:

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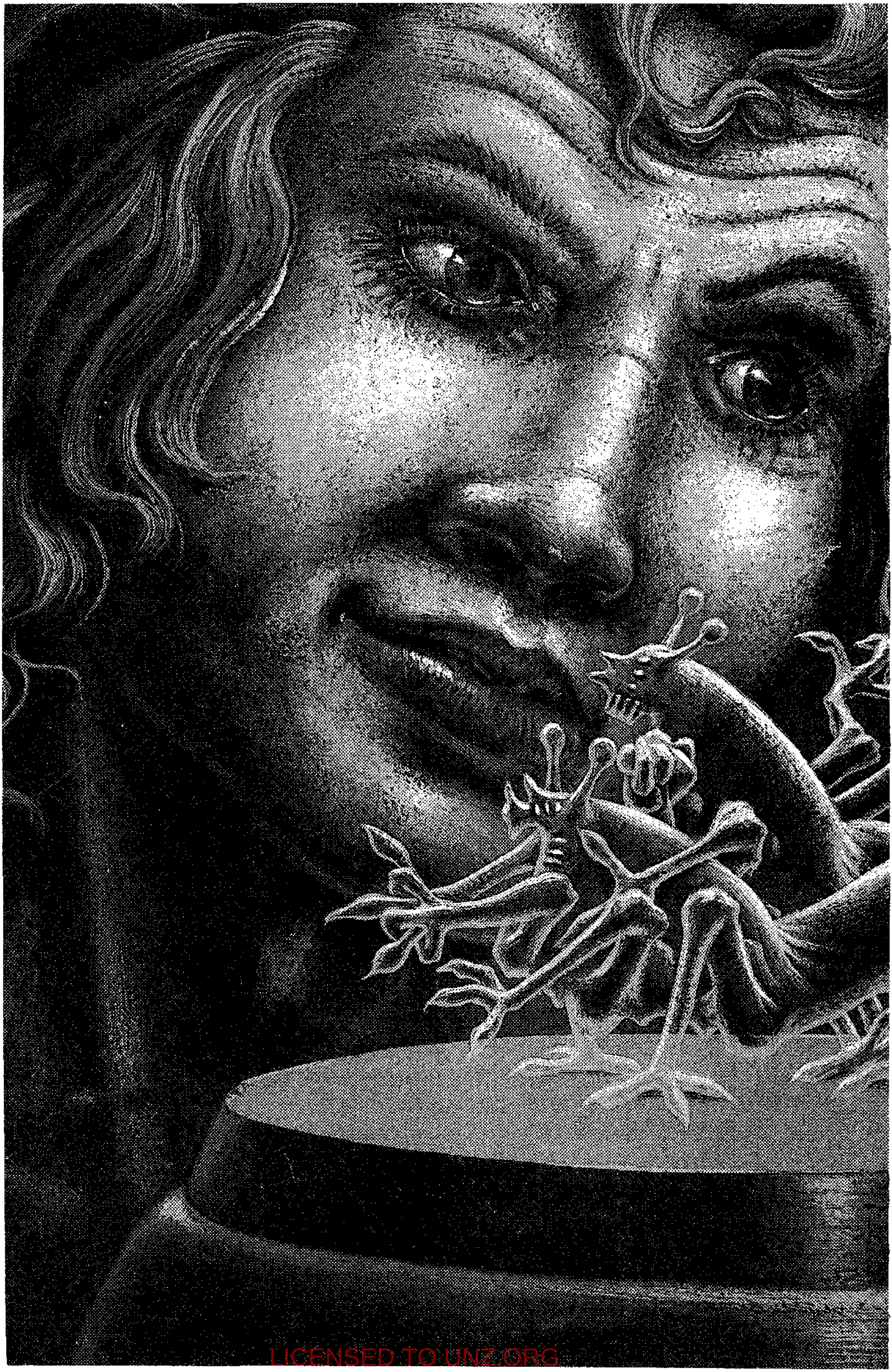
I also plan to attend cons and set up panels where we can discuss this plan in more detail—or come up with others, since I cannot say this is the only way. I am willing to work for this because tomorrow matters to me.

Do you want to be part of doing one magnificent thing? Does the future matter enough to work for? Will you pass on SF's letters from the future, or will you allow the status quo's defenders to go on mucking things up and poisoning tomorrow's minds? A possible you, 20 years from now, might have two responses:

"I could have done something magnificent," or—as you attach your rebreather to walk to the market—"I should have. . . ." ■

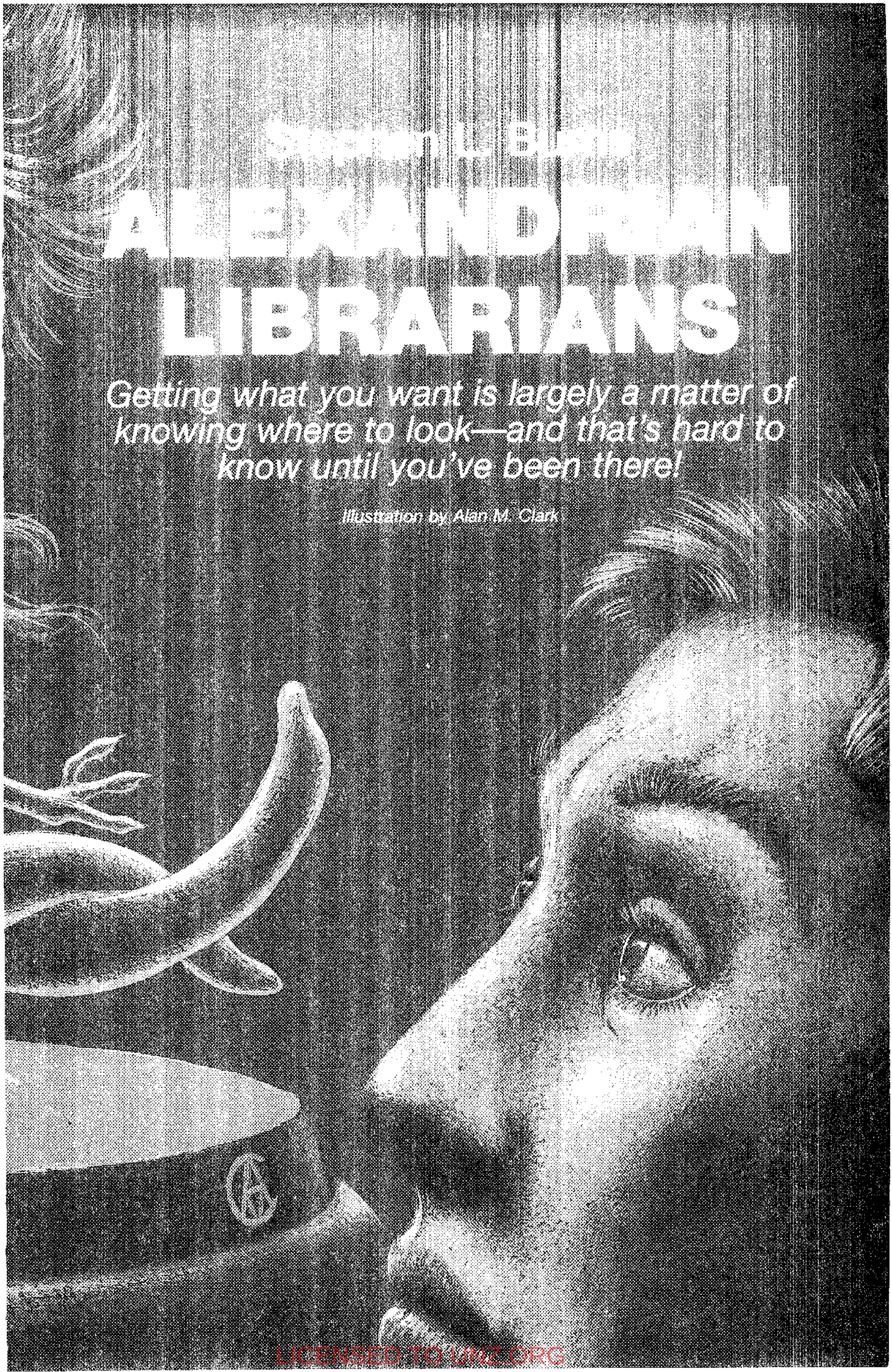


Stephen L. Burns

ALEXANDRIAN LIBRARIANS

Getting what you want is largely a matter of knowing where to look—and that's hard to know until you've been there!

Illustration by Alan M. Clark



Few of my colleagues find headhunting all that appealing, but I rather enjoy sitting behind my lonesome table in Armstrong Hall once a year and watching the greenies go by.

Ivesta Outward Lines is set up next to me, and they always draw a good crowd. Some of the greenies getting pitched there glance my way, their gazes sliding disinterestedly away again when they see the ugly hand-drawn placard reading HISTORICAL PRESERVATION OPERATIONS. *Captain Tephillip Ornish*. Sometimes they hold their noses or mime yawning.

I don't let their reaction bother me. Our reputation is something we all work very hard to maintain.

It isn't always easy, but I do my damndest to be backSol for the Academy's pre-graduation Recruitment Day. This time I cut it especially close, coming in from the big digs on Bloormojke II late last night, just in time to kill a few post-midnight brandies with Serafina and let her know that her best eye for fresh meat was ready for the hunt.

The greenies filling Armstrong Hall all look so *young*—seemingly younger every year thanks to the Doppleresque effect of my own aging. I can see their dreams shining on their faces and gleaming in their eyes. Now and then one of them will have just enough of that certain something I'm looking for to make me access the AdMem socketed behind my ear, but so far none of them have made my pulse jump.

So I just drink my coffee and stroke my shaggy mustache and watch and wait. My modest hangover fades as time passes.

Then a new face emerges from the crowd's youthful Brownian motion. One look and my heart begins to beat a little faster.

She is tall and black and broad-shouldered. Her head is shaved, and she has a stubborn chin. Judging from the sheaf of flimsies in her hand, I would guess that she's hit every table here—every one but mine. Unlike most of her classmates, who have the faces of children set loose in a candy store, she wears the faintly displeased frown of someone looking for something she isn't finding.

A directed thought starts my AdMem, and it begins telling me about her. Alessandra Desmond is her name; Cerean, age 25; top 15% of her class in terms of classwork, top 5% in simulation skills; her overall rating quite a bit below that because of a fairly hefty infractfile. The info spools on, but I'm not really paying it any mind. I know she is a perfect candidate for our motley, rustbucket Prezzie fleet.

She senses my attention and turns to stare at me.

I smile and beckon her over. Her frown deepens. She looks around to see if anyone is watching, gives a little shrug and approaches my table with an air of glum challenge.

"Good day to you," I say, sitting up a little straighter so she will take my captain's insignia a little more seriously—though probably not enough to cancel out my mud-brown, ineptly cut bad joke of a uniform.

"Captain," she answers grudgingly. "Sir." It worked.

"Tell me," I say, offering a dog-eared,

crudely produced flimsy, "Have you ever considered signing with Historical Preservation Operations?"

Her frown dissolves into a truly wonderful grin. "You must be joking," she says with a laugh.

I laugh along with her, positive she's just what I'm looking for. As I laugh I tag her dossier and register it with Placement. Historical Preservation Operations may not get much in the way of money or publicity, but one thing we do get is incontestable pick of three greenies each year. Some years we find them, some years we don't.

I've just found this splendid creature, and even if I don't find two more, my trip will have been a success.

Of course when she finds out that she's been assigned to the Prezzie fleet she's going to feel completely misplaced and screwed over. They all do.

I know I did.

Graduation was behind me. It was my very first cruise as an actual crewmember of a real starship.

I was off-duty and holed up in my quarters, adding a few more bitches to the long and bile-filled tacx I planned to send my friend, former classmate and occasional lover Ivania Bleinstein, when my horrible misbegotten sentence to the hellhull I was on ended and I finally got backSol. My grievances began with the majbitch which had made me subject to the mins; namely the rotten, royal and utterly unbelievable screwing over Placement had given me.

Every so often I would pause to take gloomy stock of what had become my lot in life; my lumpy, grav-controless bunk, obsolete percomp and antique vertainment console. A previous occupant with bizarre tastes and too much time on his hands had painted the scratched plazic cabin walls with some sort of hideous mural. The aliens in it always seemed to be laughing at me, which at least wasn't as unnerving as what the ones in my hygiene cubicle were doing.

The rest of the ship was just as disheartening to behold. While the *Gibbon* was stardriver equipped, she was also a dumpy old rustbucket whose systems were decades out of date, and whose raddled, run-down condition marked her as at least ten years past the time when she should have been junked.

The manifest injustice of my assignment was so glaringly obvious that I still couldn't believe that the one appeal I'd had time to register with Placement had been turned down. With my grades I should have been a junior officer on one of the big sleek interstellar liners, my crisp white uniform drawing the adoring eyes of rich and nubile fem passengers, and my destinations exotic ports of call like Neu Paris, Sunflash or Glimmermere. Or I should have been a JO on one of the huge colony ships, giving adventurous settler fems a chance to add to the genetic diversity of the worlds they were going to help populate. Or a JO on one of Contact Corp's swift, subtly armed ships. Or—

In other words, I should have been *anywhere* other than stuck on a fugitive from the scrapyard geosynched over a dead world, waiting around while a bunch of uffy braincases got their rocks off pawing over a bunch of crap so old you couldn't even tell what it was.

It was boring, unfair, unbearable, and if I couldn't get Placement to give a serious hearing to my next appeal it was a guaranteed dead end, my career slagged before it even began.

I was not a happy crewper, and I was caught completely by surprise by the eardrum-rattling, blood-curdling whoop of the ship's emergency siren.

My pad went flying off my lap as I leapt to my feet, and I nearly broke my nose when my compartment's sluggish door opener didn't get it out of my way quite fast enough. Seconds later I was running down the corridor toward Command, hand cupped around the pain in the middle of my face and cursing nasally around it.

The siren died just as I squeezed past that still-opening door. "Present, ma'am!" I puffed as I reached the command console, coming to attention and saluting the *Gibbon*'s captain.

Captain Serafina Chandaveda was a chunky, brown-skinned woman in her late thirties, whose concept of proper uniform leaned toward baggy shorts, garishly patterned shirts with the sleeves torn off, and no shoes. She looked up from her glum contemplation of her boards. "That's good, Ornish," she said mildly. "Very prompt response."

"Thank you, ma'am—" I began, but she'd turned her attention back to her boards. So I waited at attention for my orders.

In the hundreds of emergency simulations I'd been through back at the Academy things had always happened very quickly, potential disaster averted by fast decisive action. But Captain Chandaveda just sat there, kinetic as a chess player.

And sat there. . . .

After a couple minutes of this I couldn't stand the suspense any longer. "Isn't there an emergency, Captain?" I asked cautiously.

She sighed and rubbed her round brown chin. "Well, we've got a problem, anyway. Come on in and take a look."

"Yes ma'am." I hustled partway around the compartment's circumference to enter the horseshoe-shaped command area. That inner deck was supposed to rotate, but it was stuck in one position.

When I came up behind her she pointed to one particular screen. "See those areas flashing red?"

"Yes ma'am."

"Any idea what they are?"

I concentrated on the various reads. "That's K'leven's moon." The planet the Prezzies were down on was cataloged as K11-21B/G271/B3, but we'd all been calling it K'leven for short. "The sensor readings seem to suggest some sort of, uh, gravitational anomalies on its surface."

She nodded. Her chair squeaked as she turned to face me. "Very good. Any idea what they are?"

I didn't have a clue, but that wasn't something I wanted to admit. "First I'd need, uh, more comprehesive scanning and first order extrapolation, which, ah—"

"Which this old tub hasn't got in her," she finshed with a faint sarcasm. "In other words, no." She crossed her arms before her ample bosom. "You may have noticed that the planet and its satellite look like they've had large chunks torn out of and blown into them. Does that suggest anything?"

"Dr. Xan said they had a war, ma'am," I began uncertainly. The leader of the Prezzie expedition had said lots of things, but to be honest I had tuned most of them out. Every conversation seemed to turn into a class, and I'd already graduated.

The captain let out a derisive snort. "They had their own personal vulking *apocalypse,* Ornish. These folks discovered at least some crude form of gravitic control, and they used it to take potshots at each other using chunks of their worlds bigger than this ship as ammo."

I tried to imagine such a thing, and came close enough to not want to get any closer. That much mass impacting at even meteoric speeds would release the same sort of energy as a several gigatonne bomb. It was no wonder there were no overt signs the place had ever been inhabited.

"So what we're seeing here is big trouble brewing," she went on, snapping me out of my appalled daze. "It looks like either our arrival, or something our friends down on K'leven did has managed to wake up a weapons system left over from the war fought here."

I stared at her in disbelief. "But they said both K'leven and its moon have been dead a thousand years!"

She shrugged. "Hey, every military wants its weapons built to last longer than the targets they're used on. It looks like our lobster people got their money's worth. According to what the *Gibbon*'s guts can predict, the area where the expedition is working is going to get hammered with half a dozen chunks of rock weighing a few hundred tons each less than four hours from now."

I don't know which I found scarier; what she had just said, or the matter-of-fact way she said it. "So what do we do, ma'am?" I stammered.

She squinted up at me. "First quit ma'aming me every vulking time I turn around!"

I went to parade rest, head bowed meekly. "Yes'm."

"As for what we do about it, I plan to stay right here, monitor the situation, and have the *Gibbon* somewhere other than geosynched between the moon and ground zero when the rocks start to fly."

She stood, looked me up and down. The expression on her face said she wasn't too excited by what she was seeing. "And you," she said, "Are going down to get our passengers the hell out of there."

Shortly afterward I was sitting in the cockpit and at the controls of the *Gibbon*'s shuttle, rerunning the preflight checks as I waited for Captain Chandaveda to return.

Saying that I was a bit nervous would be placidifying my mental state by a twitch or twice. In the five minutes since the captain had left me there to wait while she went to get something, I'd made two dry and fruitless trips to the head.

When I first learned that I'd been sentenced to a Prezzie ship, and that while I would technically be first officer—the entire crew consisted of myself and the captain—I'd envisioned endless scutwork as my inglorious and undeserved fate.

There had been scutwork, of course, but not quite as much as I'd expected. Spit and polish wasn't Sarafina Chandaveda's style. Her attitude seemed to be that if something worked more or less properly, leave it the hell alone.

One thing I hadn't expected was this sort of sudden serious responsibility. JO's were supposed to watch and learn and leave the critical work to more experienced hands.

"I can do this," I kept muttering. I was the one who had taken the Prezzies and their equipment down in the first place, so piloting the shuttle was nothing new. The only difference this time was that their lives depended on me getting them back off again. I repeated my mantra and began another check.

"OK, Ornish," Captain Chandaveda said, nearly making me jump out of my skin. Those bare feet had let her sneak up on me like a ninja. "Here's one last piece of equipment for you."

I stood up and faced her, almost falling back into my chair when I saw that she had a gun. It was old and big and chemo-mechanical, and it appeared extremely deadly.

"*Ma'am?*" I asked, my voice an octave or two higher than normal.

"Just take it," she said tartly as she offered it to me butt-first. She scowled. "They still give weapons training at the Academy, don't they?"

"Yes'm," I answered, taking it and wondering if this was the time to mention that I had only passed the course because my instructor had taken pity on me. I was an ace at weapons safety and maintenance. The problem came when I actually tried to hit something. I checked the safety, then looked around for a safe place to put it.

"I want you to *carry* it, Ornish," she said, sounding more than a little exasperated. "Put it in your waistband under your jacket. Keep it hidden and on you at all times. It might just come in handy if they try to pull an Alexandrian Librarian on you."

"A what? I don't—"

She sighed. "Just do it, Ornish. Now get your ass in gear and get the job done. I'm counting on you." She turned on her bare heel and headed for the airlock, glancing back over her shoulder just as she went through. She gave me an odd look, then said, "Be sure and bring them back alive!"

"What?" I called, but the lock door was closing between us.

All I could do was jam the gun into my waistband as ordered, sit back down in the pilot's seat and initiate separation. The clamps released, there was a slight lurch, and my rescue mission began.

The shuttle's under-juiced and over-aged gravitic propulsion systems gave it a fairly limited payload capacity and speed; like everything else they owned, it seemed to be a fifth generation hand-me-down. Ferrying the

Prezzies and all their gear down to K'leven had taken three trips, and given me plenty of time for sightseeing.

But this trip I was seeing the planet's battered surface with new eyes. The closer I got, the more chilling the picture became.

When Captain Chandaveda had said that the war which had been fought between the inhabitants of the planet and its major satellite had been their own personal apocalypse, she hadn't been hyping the scale and scope of destruction below me. Deep craters pocked K'leven's surface, some of them still fuming sullenly these thousand years later, the wounds deep enough to have created volcanic vents. There were fissures and chasms large enough to swallow the *Gibbon* whole, the skeletal remains of rivers boiled dry and seas turned to ashy mud. Of cities, or roads, or other fingerprints of civilization there was not the faintest trace. It had been a living world, and now it was not. The difference, and just how awful the changeover had been, was finally coming clear to me.

It was hard to believe that anything could have survived intact through such a deadly barrage. But something had. Buried deep under the splintered stump of what had once been a mountain there was a thick-walled vault containing objects which the K'leven had felt worthy of such a calculated attempt at preservation. The Spyter which had first scouted out this system discovered this hidden repository on its half light-speed scan-run through. When it had come back-Sol at the end of its two year mission and disgorged the information gathered on its travels through uncharted systems, evidence of this vault had come to light. The Prezzies had immediately mounted an expedition to investigate. That's what Prezzies do.

I had eagerly awaited the first images of what was inside, imagining gold and jewels and priceless works of art, or strangely beautiful alien machinery which might give us whole new technologies. When Dr. Xan and his colleagues had begun proudly showing off what looked like half-melted bars of rock, piles of dirty plastic-plate-looking things, and heaps of what appeared to be blobs of either brown gravel or fossil turds, I lost interest pretty quickly.

Not my captain, though. She pored over anything they transmitted like it was the latest episode of some sizzy new vidrama. Too long hanging around dead planets with a bunch of yawners like the Prezzies, I figured. That was one more reason to get rePlaced as soon as I could. I didn't want the same sort of brain damage to happen to me.

The shuttle bucked slightly as it entered the edges of what remained of the planet's tainted atmosphere, steadied, continued its slow descent. On one hand I wanted it to go faster, on the other I was dreading the moment when I had to step out onto the bull's-eye below. This didn't do much to help me relax.

After what seemed like an interminable trip I finally landed at the Prezzies's base camp, a flat area near the foot of the mountain. Since they were on what had become the most dangerous spot in the whole system, and these were supposedly rational people, I had expected to find them standing by and impatient to climb aboard.

There were several tarp-covered piles of extra equipment and who knew what else off to one side of the ellzee, but the only member of the expedition in sight was Shelby, the big, old-style all-metal free aidroid who was part of their team.

"What is it with these crazy vulkers?" I grumbled angrily as I rechecked my envirosafe generator and waited for the lock to cycle through. First Captain Chandaveda acts more like she's in the middle of a tax audit than an emergency, and now the over-educated yozos I'm supposed to rescue don't even bother to show up. Was it something wrong with the *Gibbon*'s air?

"Good afternoon, First Officer Ornish," Shelby greeted me when the lock finally opened and I stepped out onto K'leven's cold, inhospitable surface. "It is indeed a pleasure to see you again."

I wasn't in the mood to swap pleasantries. "Where the hell is everybody?" I demanded.

The aidroid smiled, impervious to my obvious pique. "Why, they're inside the vault, of course."

I bit back the urge to yell that I *wasn't* an *idiot* and *knew* there wasn't anywhere *else* for them to be in this godforsaken place! "Why aren't they ready to go?" I asked, trying for brusque but sounding more like my shorts were in a swiftly tightening slipknot.

"Let me assure you that preparations are well under way." Shelby gestured toward the tunnel mouth with a blue-steel hand. "If you would accompany me, I'll take you to Dr. Xan."

I nervously looked up at the ghostly disc of K'leven's moon, back inside the shuttle airlock, then at the aidroid. "Isn't he coming out?"

"Please," he said, starting toward the tunnel mouth. "He is expecting you."

I followed after, grinding my teeth together and thinking that at least somebody would get what they expected.

"Nice tunnel, Shelby," I said to break the uneasy silence of the last few minutes, my voice echoing eerily along the rock-walled tube. The grade was gentle, but there was no mistaking that we were going down—and still farther away from the shuttle. If it hadn't been for Shelby's taglite the darkness would have been absolute.

"Why thank you," the aidroid replied, sounding pleased. "The newest generation of matter compactors are said to be faster, but I find that the old Mark Threes do just as good a job with considerably more modest power requirements. Now the Mark Fours draw—"

"How much farther is it?" I asked to keep him from going on to tell me everything I ever wanted to know about matter compactors but was afraid to ask for fear of a lecture just like the one he was more than willing to give me.

"Not far. Just a bit over 221 meters."

"They are getting ready to evacuate, aren't they?"

"Rest assured, preparations are well under way."

We were just passing through the templock set up between the tunnel and the vault when I got this nagging feeling that he hadn't quite answered the question I'd asked. But I passed it off as just nerves.

Dr. Xan looked up from the thingamagrubby he was examining, chubby cheeks dimpling as he smiled. "Ah, there you are, Ornish! So glad you're getting a chance to see our little treasure trove." He surveyed his subterranean kingdom proudly. "Isn't it remarkable?"

Hoverlites drifting near the domed ceiling three meters above us cast a not particularly flattering light across the alleged treasure trove. The inside of the vault was a roughly thirty-meter square box made out of some sort of thick, mold-green concrete-like stuff. Either the effects of the earlier bombardments had been felt even this far underground, or the concept of level floors wasn't one the K'leven had come up with before they turned each other to vaporized bisque, because the surface under my feet sloped slightly toward one corner.

There was ton after ton of stuff in there, all in piles and heaps and drifts; shelving must have been another undiscovered concept. The only things I could see which appeared to have even the slightest intrinsic value were pieces of the equipment the Prezzies had brought with them, and most of that looked like it belonged in the scrapyard. For instance the areolator which was keeping the air inside the vault breathable chuffed and wheezed as it did its work. Some of its exposed parts were repaired with tape and wire.

My first inclination was to tell him it looked like the back room from Hell's Thrift Shop. Instead I let his question pass, facing him with my shoulders back and what I hoped was a properly stern look on my face.

"Dr. Xan," I said, shooting for the authoritative tone of a ship's first officer, "You and your people must evacuate this place immediately." I'm afraid it came out sounding ever so slightly desperate, but at least I hadn't gone to my knees and begged, an option I was considering.

"Don't worry, young man," he said with a fatherly smile. "We are quite cognizant of the precarious nature of our situation. There are just a few last-minute tasks to be seen to, mostly a matter of completing the recordings we want to go on the shuttle."

"But this place is going to get smutched in—"

"We are well aware of the time constraints. Serafina has seen to that. If you wish to help expedite the process, you might assist Clotilde." He gave me an oddly conspirational smile. "You might even find what she is doing somewhat interesting."

"What is it?" I asked unhappily, looking around for her.

Tarps had been used to create several work areas. We were in one, the Fritlanders were busy in the one nearest to where we stood. He pointed to another over in the far corner. "Why don't you go ask her?"

As I've mentioned once or twice, the *Gibbon* wasn't exactly a state-of-the-art starship. It had taken 48.6 days for her sluggish old stardriver unit to carry us the measly 579 light-years from Sol to K'leven. That included twelve two-hour dropouts back into real-space to let her cranky old statexciters calm down. We had learned about dropouts as an emergency procedure at the Academy, but plugging them into the flight-plan ahead of time the way Captain Chandaveda had done was something definitely not written into the curriculum.

So it was a rather long trip, made longer by my knowledge of how much faster a decent ship could have covered the distance. By the end of my first week I was bored out of my skull. For the first few days, when I wasn't standing watch—my orders were that if something went wrong I was to yell for help and for Shiva's sake not *touch anything!*—or attending to my other duties, I went to the ship's salon and tried to make conversation with our Prezzie passengers.

Dr. Fu Xavier Xan was a nice man, and friendly in his way, but he spent most of his time communing with his percomp. Just once I asked what he was reading. Five hours later my head was literally spinning from the highly compressed three credit course I'd just been given on "rotational kakistodemocracy," a political system practiced by a race which had died out some half million years before I had been dumb enough to ask my question. After that I just left him to his reading.

The tall, spindle-limbed T'thiggan who insisted that everyone just call him Elvis spent most of her time (T'thiggan's are both) sprawled in a recliner, custom headphones over all four ears and his eyes rolled back in her head, listening raptly to presecondmill Earth music. Sometimes he sang along. Her voice was actually quite good, if a little strange. While I was tempted to ask what *Lew-weeee lew-eye, whoa-ho* meant, I had learned my lesson with Dr. Xan.

Shelby spent most of his time plugged directly into the *Gibbon*'s systems, fighting simulated wars with the ship's main computer. We could always tell when the ship was losing because it either overcooked our meals or served them still half-frozen. Shelby was quite the general, which meant that we ate badly most of the time. Nobody complained, they just offered tactical advice.

The Fritlanders, Doctors Lars and Lessie, were a husband and wife team of linguists who had been together for so long that they had begun to look like each other. Lessie was the one with the shorter hair and bigger bustline. They spent most of their time locked in their stateroom, and had remarkably little to say when they did come out. According to Dr. Xan they were translating a Langoozyle sex manual; an over thirty million entry compilation of every sex act performed by every member of that race over a one-year period. The noises that came from their room sometimes suggested that parts of it might have been pretty hot stuff.

Completing this scholarly sextet was the most junior member of the expedition. Dr. Clotilde Miskovitch was her name, she was about my age, and the reason why by the end of the second week of our voyage, I was spending most of my spare time hiding in my compartment with the door locked.

The Prezzies were a bookish lot. Clotilde was built a little like one; kind of squarish and thick-bodied, a little frayed at the corners, and of course containing one hell of a lot of words.

For the first few days she scarcely spoke to me. She just sort of *observed* me with an intensity which made me wonder if she was considering dissection as a route to further knowledge. Then suddenly about seven days out she turned up in the salon dressed to kill—or at least cause eye damage—wearing quite a bit of inexpertly applied makeup and even more perfume. She cornered me in a lounger, hung her modest, heavily fragranced breasts a few inches from my nose and began her studied seduction.

Now I found Clotilde nice enough, and actually kind of cute in a sturdy, foursquare, overly bookish sort of way. The problem was, her idea of flirting was to combine her somewhat shaky concept of feminine charm and her insanely overdeveloped intellectual skills and use them to try to bludgeon me into submission.

Except for the little lovetacxes she kept sending, I'd had a few Clotilde-free days while she and the others were down on K'leven. Any overture I made now would probably be seen as proof that Cupid had done his work, beating me senseless into compliant mush—probably using a couple dozen textbooks, a dictionary, and an entire set of Encyclopedia Astrica. But if offering to be her slave was what it took to get them in gear and off that damn planet, then duty demanded that I take the risk.

Back behind the tarp she was examining something that looked like a fossilized turd with an old Omniscan. I took a deep breath to brace myself, then went and told her that Dr. Xan had sent me to help.

"That's very sweet of you, Tephillip," she cooed, batting her stubby eyelashes at me. My guard immediately went up. Big words meant an intellectual assualt, small words meant physical persuasion. The fact that her coverall's front closure gaped open halfway to her navel gave me further warning.

I shrugged uncomfortably. "I just want to get you folks out of here as fast as I can."

"Of course you do." She looked around at the heaps of stuff surrounding us. "We really hate the thought of quitting so soon. We've hardly begun to scratch the surface of what's here."

"I wouldn't want any of this crap under my nails," I joked.

That got me a blank look, then a slightly condescending smile. "I see, you're making a joke."

"So what are we supposed to be doing?" I asked to get things moving and reduce the risk she'd bust a gut laughing.

She showed me the brown blob in her hand. "Quick-scanning these."

"What are they?"

"Something between a holopix and

a kinesthetic sculpture."

I figured she probably knew what she was talking about, but it still looked more like a coprolite than a Cornavecchi. "Not very, um, evocative."

That did make her laugh. "The archived material is encoded inside it, silly."

"So you crack them open, or what?"

More hilarity. "Here, I'll show you," she said when she got control of herself, moving the object into the scanner's field.

A holo sprang into being before us. It showed two of the lobsterlike K'leven wrestling. She turned it slightly. The one on top got a little closer to pinning the one on bottom.

"So what is this, like the sports page?"

She gave me that dissecting look, only this time she was smiling. "Actually, we believe it to be a form of erotica. There seem to be both textual and musical components encoded in the artifact's structure. I'd hoped to crack them and make fully translated recordings, but now it looks like the best we can do is take static scans and hope all the information will be preserved so it can be decoded later."

I gave the holo a closer look. "So you're saying that this could be part of their Astra Sutra?"

"Or a pillow book, or a religious text, or a honeymoon memento, or a school sex manual. We're a long way away from understanding these people well enough to put what we've learned so far into any social or historical context." She handed the thing to me, her fingers lingering on mine.

I put it back in the scanfield for one more look, turning it this way and that to see if the lobsters did anything familiar. They didn't. I wondered if maybe this was just foreplay, and the steamy stuff came later. "Do you know how they, you know. . . ."

"Yes." Clotilde took the lobster porn back again. "Now if you'll get more of these from that pile over there and scan them, I'll tag and register them. All right?"

"Sure." Then I remembered that we were about to get flattened—after actually forgetting it for a couple minutes. "But we have to *hurry!*"

"Don't worry," she said, fondling my shoulder reassuringly, "We'll be done when it's time for the shuttle to go."

Before long we got a rhythm going. It was kind of mindless work—or at least my end of it was—and after a bit my mind began to wander. I found myself wondering if handling all this sexy stuff was making her feel, well, sexy. My mind being what it was at that age, this and occasional glimpses of her cleavage led me to wondering what she'd be like in a clinch, and I'm sure you can guess which gutter my thoughts headed for after that.

The upshot was that I was caught completely by surprise when Dr. Xan came bustling around the tarp. "Time to give me your scan data, Clo," he said as he joined us.

I took a look at the dat on my wrist, my insides congealing when I saw what time it was. "We should have left an hour ago!" I moaned.

"Don't worry, Tephillip. We're right on schedule," she said as she powered down the Omniscan and pulled a permem from its innards. "Here's my data, Xav."

"Excellent." He took it from her and slipped it into the battered metal briefcase he carried. "Shall we away?"

Nobody needed to ask me twice. I headed out, looking around when I got past the tarp curtain. "Where are the others?"

Clotilde and Xan came up behind me. "They are already up at the shuttle," he said. "Our preparations are complete."

"Come on, Tephillip, you can't hang around here any longer," Clotilde said, making it sound like I was the one who was keeping them waiting. She hooked my arm in hers and began towing me across the vault toward the tunnel.

Dr. Xan followed behind, wearing the benevolent smile of a man who is finally seeing a chance to marry off his spinster daughter.

Much to my relief the others were waiting by the shuttle. By the time we got there, I'd realized that I was going to have to take control of the situation and keep it.

"Good," I said, sounding brisk and businesslike. "Everyone's present and accounted for." I pointed at the already open airlock. "Now if you will all get aboard we can get out of here."

Nobody moved, and a funny look passed between them. The Fritlanders shared small, identical smiles. Elvis shuffled her big flat feet and sang something like *can't get no uh huh hum* in a low voice. Shelby looked mildly embarrassed. Clotilde would not meet my gaze, her expression almost guilty.

Dr. Xan laid a chubby hand on my arm. "We're staying here, Tephillip."

It took me a couple seconds to make sense of what he'd said, and another couple to make myself believe I'd heard it. "You're *what?*"

"Staying here. Holding the fort, as it were."

"Are you vulking *nuts?"* I wailed.

A calm smile. "I assure you that we are all in complete command of our faculties. Our decision is a logical one. Our consensus is that the vault has survived everything thrown at it so far, and should come through one more barrage unscathed."

I shook my head in denial, disbelief and desperation. "No way! I *order* you to get on that shuttle right this instant!"

"I am afraid that's logistically impractical, if not outright impossible. It is already carrying its maximum payload in artifacts. Shelby is quite the master at calculating payloads, you know. Our combined mass added to what is already aboard would take the craft far over its operating limit."

I looked around. Sure enough the big covered piles were gone. Loaded on while Clotilde kept me distracted. I shot her a black look, and she at least had the decency to blush.

Inside I went from panic to anger to outrage to a weird sort of calm in three seconds flat. When I looked at Xan I was smiling myself. "So let me see if I have this straight," I said. "I'm supposed to rescue a bunch of junk—"

"*Artifacts,*" he corrected with a sniff.

"Artifacts, then. I save that stuff and leave all of you here to risk that vault surviving another barrage. The logic behind this being that if you and the vault survive, no harm done. If it doesn't, at least all the incredibly valuable artifacts you put aboard instead of yourselves will be saved."

They all nodded in unison. "You have an excellent grasp of the situation," Dr. Xan said approvingly. "You are a most perceptive young man."

"Thank you, sir." My smile began showing less humor and more teeth. "I also happen to be a very pissed off young man, and I have an excellent grasp of one other thing."

"What might that be?"

I pulled out the gun Captain Chandaveda had given me.

"This," I said.

The response to this gambit wasn't all I'd hoped it would be. Nobody looked particularly frightened—or even impressed. I knew the gun looked scary, so it had to be me.

"You wouldn't shoot *us*, Tephillip," Clotilde informed me in the tone you would use on a backward child. "Now put that thing away before you hurt someone."

Now what? I asked myself, painfully aware of how fast time was running out. Once again my Academy training had let me down by not covering the threatening and/or shooting of passengers in a real depth. I stared at Xan, who radiated a calm confidence that I wouldn't hurt the people I'd come to save. The problem was, he was right.

But my captain had sent me down to rescue him and these other maniacs, and I intended to complete my mission.

They always speak of inspiration *striking*. That's what happened to me next. My brain gave a sort of hitch that made me blink, then I lowered the gun so its muzzle was pointed at the briefcase Xan carried.

"No," I said in as menacing a voice as I could muster, "But I'm perfectly willing to blow your data all to hell."

His round face went pasty white. "You wouldn't! This material is priceless and irreplacable!"

"So are all of you. So is my commission. So—" I jerked my thumb toward the airlock. "I suggest you get your over-educated asses in there this instant."

Nobody moved.

I pulled the briefcase out of Xan's hand and jammed the gun up against it. "I said *move!*"

While that didn't exactly start a stampede, they didn't dawdle either.

Once inside, I learned that not only had they filled the shuttle cargo hold, they'd stuffed the cabin section full of K'leven leftovers as well.

There wasn't time to clear off the passenger couches, or to see if I had enough control over them to get them to toss some of their precious artifacts overboard. So I had Shelby lie down on the one bare patch of decking and the others sit on him. Once they were settled in, I put the manual restraint field on at full power to keep them out of my hair.

I had to climb over piles of stuff to reach the pilot's chair. The briefcase went between my feet and the gun went back into my waistband, but I made sure it was within easy reach.

My first look at the boards told me that my problems were still far from over. The payload indicators were showing me big numbers in an ominous red, the hazard avoidance systems were flashing ultra-urgent warnings that several giant chunks of K'leven's moon were hurtling toward where we were sitting, and my captain wanted to have a word with me.

"Here goes nothing," I muttered, initiating lift. Then I opened a tacxline to the *Gibbon*. Captain Chandaveda's face appeared on the screen. She looked somewhat aggravated.

"It's about time, Ornish. I was beginning to think you'd gone AWOL. Are you having a problem down there, or did you just plan to hang around for a while and get stoned?"

"I've got a problem, ma'am." The shuttle shuddered and began to lift with agonizing slowness. "The vulking Prezzies stuffed the shuttle full of junk from the vault."

"Artifacts!" came a chorus behind me.

"I had to hold their data at gunpoint to get them to board. Now we're so overloaded we can barely move."

"Sounds like you have your hands full," she commented with a marked lack of sympathy. "I'll stop being a distraction. See you when you get up here." With that she broke the connection, leaving me staring at a dead screen.

"Thanks for all your help," I growled, searching my boards for some clue as to how to get out of this predicament. Then I looked again, hoping there was something I missed. No such luck.

Less than four minutes remained until impact, we were less than a hundred meters up, and while our rate of ascent might have made an arthritic vulture carrying off a dead heifer proud, all it was giving me was a sour, sinking feeling that my next flight would be on angel's wings.

My fingers did a fast, sweaty flamenco, asking the shuttle's computer a dozen questions.

I started getting answers I didn't really want to hear. The shockwaves impact was going to cause would be far nastier than the shuttle's shields and hull could withstand. To survive them, we had to be almost halfway around the planet or pretty much clear of the atmosphere. The fastest way to clear air was to go straight up—right toward the oncoming Rocks of Doom—and our present rate of climb just wasn't fast enough to get us to vacuum in time. I compromised, peeling us off at a slight angle so we weren't on a head-on heading.

The only thing in our favor was that escape velocity wasn't a problem for the shuttle since it used gravitic propulsion. You just keep negating gravity until there isn't any more. It was getting clear of that shockwave which was our deadline. One we were going to miss by a considerable margin.

Back in the Academy simulators we called a situation like this a *phillips head,* so named because no matter what you did, you were completely screwed and in the crapper.

What we needed was more acceleration. The gravgrid under the shuttle was running at redline. I had the small maneuvering thrusters running at full. While making the SOBs who had gotten us into the mess get out to push might have made me feel better, that wouldn't help either. The only propulsion system not running flat out was the other gravgrid on top of the shuttle.

Gravitic propulsion needs either a gravity field or at least a reasonable amount of mass to either react against or pull toward, the amount of lift and delta V constrained by several factors: the class and power rating of craft's systems; the mass of the craft itself; the mass and gravitational pull of the bodies you are heading to and/or from, and the distance to those bodies. Much complex math here, but of a kind the shuttle knew how to do.

In other words, to use the topgrid I needed something above us to hook onto. So I ran some numbers.

Another dead end. K'leven's moon was too far away to add all that much lift. The *Gibbon* was closer and sufficiently massy, but the geometry sucked. Heading toward her would force me to take a longer flight path through more atmosphere, and we'd still be in air thick enough that the odds of the shockwave smutching us were seventy to thirty.

On our present course the odds were seventy-two to sixty-eight. So I loaded the course correction to veer us off toward the *Gibbon* and gain us that pointless increment of lift.

Just as my finger touched the surface of the pad which would initiate the change I froze. It was another case of inspiration striking, only this time it hit like a ten-ton gumball. I let out a strangled sound of dismay at the insane idea which had just stepped out onto the front of my brain, looked me in the inner eye, grinned and said, *hey sailor, what do you think of ME?*

"Are you all right, son?" Dr. Xan called from behind me.

I ignored him, moving my hands and preparing to run the numbers on the plan my possibly snapped mind had just given me.

A crazed chuckle rose up out of some deep and strange place inside me. "To hell with it," I said, still cackling dementedly as I laid in the new instructions and initiated them.

The overloaded shuttle shied onto its new vector, moaning in protest. Noticeable acceleration settled over us as the topgrid sank its ethereal hooks into those oncoming rocks and began hauling us right toward them in a game of megalithic chicken.

Now I was getting a readout that was less than encouragingly labeled TIME TO IMPACT. It started at just over three minutes, and the numbers were changing faster than realtime because the closer we came to those stony spitballs, the more acceleration I could wring from them. I watched them flicker madly, sweat trickling down my sides.

When less than thirty seconds remained until we occupied the same space as those baby mountains I put my hand over the pad which would initiate our final, but hopefully not *fi-*

nal course correction.

"Better hang on—" I called to my passengers. Ten seconds left.

"—This just might—" Five seconds. The slap of a pad unlocked the top-grid from the Stones of Death, stood the shuttle nearly on its side and latched onto the *Gibbon.*

"—Get a little—" A fiery chunk of K'leven's moon, the size of Gagarin Hall back at the Academy, roared by us with less than five hundred meters to spare. The shuttle bucked as the pressure wave its passing created hit us, but that too added another bit of acceleration.

"*—Rough!"* One screen tracked the monster buckshot on its flaming descent. The shields were on full, and while we had reached the uppermost edges of the atmosphere, we still weren't completely clear of it. The rocks' kamikaze death-dive ended in a blinding blue-white light so sudden and so bright some of it made it through the shuttle's luma-reactive ports.

The wait for the shockwave seemed to take an eternity, one I spent pounding on the arms of my chair and going, *"Come on baby, just a little faster, you can do it, just a little farther—"*

When the wave front hit it was like a massive hand had come up under us and flung us like a shotput. My boards erupted with dire warnings and reports of systems failure.

The wonder of it all was that I was still alive to deal with them.

Just about an hour later I was still sitting in the shuttle's cockpit. The boards were quiet, and there was no sense of motion. That was because it was snugged safely into its bay aboard the *Gibbon*.

My passengers had already debarked. They had interrupted their heated discussion as to whether the vault might have survived (it was one to one with four abstentions), and whether there might be well-hidden military emplacements the Spyter had missed worth investigating on K'leven's moon, to each thank me for saving their artifacts and data—and by the way, their lives too. Clotilde slapped a vigorous liplock on me, then whispered that if I came by her quarters later I might just be given a proper hero's reward.

I just sat there in the silence. My plan was to get up and leave the shuttle once I stopped shaking. I had high hopes that would happen before my thirtieth birthday, which was a mere four years away.

Captain Chandaveda materialized beside me on her bare and soundless feet. For once she didn't startle me. My nervous system was beyond such responses.

"Shutdown checkout going a little slow, Ornish?" she asked, one eyebrow arched in inquiry.

I shook my head. "No ma'am. It's done."

"Good." She parked a meaty hip on the edge of the control board. There was a bottle and two glasses in her hands. She filled both glasses, handed one to me. "Here, drink this."

"What is it?" I asked dully.

"Nerve tonic. Go on, have some."

"Yes'm." I accepted the glass. She

tossed off hers like it was water. I tipped my head back and took a swig, nearly choking as what felt like liquid antimatter ate its way down my throat.

"It's 170 proof nerve tonic," she added with a smile. "Maybe you'd better just sip it."

When I could breathe and see again I looked at her through watery eyes and gasped, "Thanks for the warning."

Her smile turned into a big grin. "You did a good job, Ornish. I'm damned proud to call you my first officer, and I'd like to make it a habit. I hope you'll reconsider trying to get out of serving on the Prezzie fleet."

I gaped at her in open-mouthed surprise. "How did you know I—"

She laughed. "Honey, when they first dragooned me into this fleet and my appeal was turned down I seriously considered mutiny as a way to get out."

"You're kidding, right?"

She refilled our glasses. "Nope. I was fit to be medicated. Then toward the end of my first voyage things got kind of interesting. Not as interesting as they did for you today, but enough to make me hold off taking my captain hostage."

I don't know what I found harder to believe: her story, or her matter-of-fact attitude about what had just happened. "You call what I just went through *interesting?"*

"Sure wouldn't call it dull." She took a swallow from her drink. "You weren't really in all that much danger. The *Gibbon* has gravitics too, and a little atmospheric scorch wouldn't have made her any uglier. I was locked onto you and ready to haul your ass out of there if I had to." She saluted me with her glass. "Never had to lift a hand, though. You cut it pretty close, but you pulled it off all by yourself."

I shook my head in dazed amazement. "I never even thought of asking you to do that." In fact, the two fields working together in gravitosynchronicity would have given the shuttle all sorts of lift, even if she hadn't dropped orbit.

"Don't feel bad. I didn't exactly encourage you to ask for help, and your first thought was to get yourself out of the jam you were in. Which you did. I was betting you were up to the job, otherwise our headhunter wouldn't have picked you for Prezzie duty in the first place. We know how to pick the best and brightest, Ornish."

I appreciated the left-handed compliment, but I'd been chewing on my own liver about getting assigned this duty for so long I still had a bad taste in my mouth. "But why *me?"* I demanded. "Others had better marks than I did."

"Lots of reasons. Here's one. Tell me, had you settled on what branch you wanted to enter after graduation?"

"No ma'am," I admitted miserably.

"Of course you hadn't. Because none of the other services offered what you were looking for."

"I guess. But I still don't know what it is I wanted."

"Well, I do. It was something none of the others said they had. You wanted to be more than one small uniformed cog in a big well-greased machine. You wanted challenge and excitement. You wanted adventure—which isn't what you thought you'd get dragging a bunch of fusty bookworms around to dead planets, is it?"

"I guess not."

She patted my knee. "Now not every trip gets this wildly interesting. Sometimes the payoff is a few years down the line, when you find out that you were there when the Prezzies found some new music or literature, some scientific or medical advance, some new piece of the Big Fuzzle that changes the way we look at the Universe. Every trip is a crapshoot. Take this stuff you just brought up from K'leven. Who knows what sorts of secrets and wonders Xav and his people might extract from it? Shiva, if nothing else you just helped keep a race that has been dead a thousand years from being completely forgotten." She shook her head. "That's no small thing, Ornish. It's a very great thing."

"I guess." I drained my glass and sighed. My brain hurt from absorbing all of this on top of my earlier excitement.

"OK," I said after a moment, "Maybe this duty isn't as bad as I'd thought it would be. But if the stuff the Prezzies save is so valuable, then why can't they afford better ships? And why does their reputation, well, vac so bad?"

My captain's smile said she was pleased with me for having asked those questions. "The information learned and artifacts gathered on an expedition like this are freely published and displayed for those who have the wits to see their value. Historical Preservation Operations are done for the love of knowledge, and for the value of adding to that knowledge, not for money or fame. And as to the other—"

She laughed and spread her arms. "We're greedy! If everybody thought this was a way to get rich, they'd try to horn in on our action. Better our branch remains dull, poor, and boring. That way we get to keep all this for ourselves."

I sat there mulling over what she'd just said, realizing that the Prezzie life—and being part of their fleet—was like one of Clotilde's blobby rocklike thingies. Not much to look at from the outside, but inside there was wild music and lobster orgies.

I drained my glass again. I could really feel the effects of what I'd been drinking. "I still have one question, ma'am—uh, Serafina."

"What's that, Tephillip?" Hearing her use my first name made me shiver. It made me feel like I had just become her peer, and I kind of liked the feeling.

"Teph. My friends call me Teph. Just before I went down, you gave me that gun and said something about Alexander's Libraries. What was that all about?"

She looked toward the shuttle's airlock to make sure we were alone, then leaned close. Her voice dropped to a conspirational whisper. "That was the Alexandrian Librarians. It's one very important part of the job, and one we don't talk about around our passengers. A long time ago, back before the first millennium, there was a great library in a city named Alexandria. It was the greatest repository of learning and literature of its day, and it was sacked and burned by an invading army. Around the year 2000 a minor, obscure writer named Byrne or something like that asked the question, *What happened to the Alexandrian Librarians?* The answer he suggested to his question was that they probably died trying to save the library's contents. We don't remember the guy's name, but we never let ourselves forget his conclusion that people who love learning so much that they've dedicated their lives to it are quite likely to put the survival of that learning ahead of their own."

"Like they did today."

"Just like. Running a ship is just half our job. The other half is protecting them and what they learn. They can be completely blind to risk, sometimes. We have to be their shield."

She stood up. "Speaking of our dusty band of scholars, I believe they are in the salon, waiting to throw a party in your honor. Shall we attend, First Officer Ornish?"

I stood up as well, swaying from the effects of the nerve tonic. Then again my nerves felt a lot better than they had in quite a while. "Will there be something to drink? I think I could use one more."

"Count on it." She eyed me critically. "But maybe you'd better hold off for a while. Much more alcohol and Clotilde is going to start looking good to you."

I pulled myself to attention and saluted my captain. "Then maybe I'd better have two, ma'am."

I served as first officer under Serafina for eight years—conducting a loose but highly educational affair with Clo for the first three—then became the captain of the *Gibbon* myself. Nine years after that I turned her over to my first officer and took on the job of converting a worn-out heavy cruiser named the *Leonardo* into a functioning Prezzie craft. A few years later I handed her off the same way as I had the *Gibbon.*

Now I captain the *Marie Curie.* Serafina is still my boss, only now she's in charge of the whole slap-patched Prezzie fleet. It's one of the high points of my year to come back-Sol, renew our friendship, and sit at our table in Armstrong Hall and watch the greenies go by.

Alessandra Desmond is still laughing at the absurd notion of signing on with us.

I laugh with her, but some of my pleasure comes from having found such a fine candidate to help protect our precious Alexandrian Librarians.

I know she's going to hate it at first.

I think maybe I'll ask Serafina to assign her to me, just so I can enjoy watching her get over it. ■

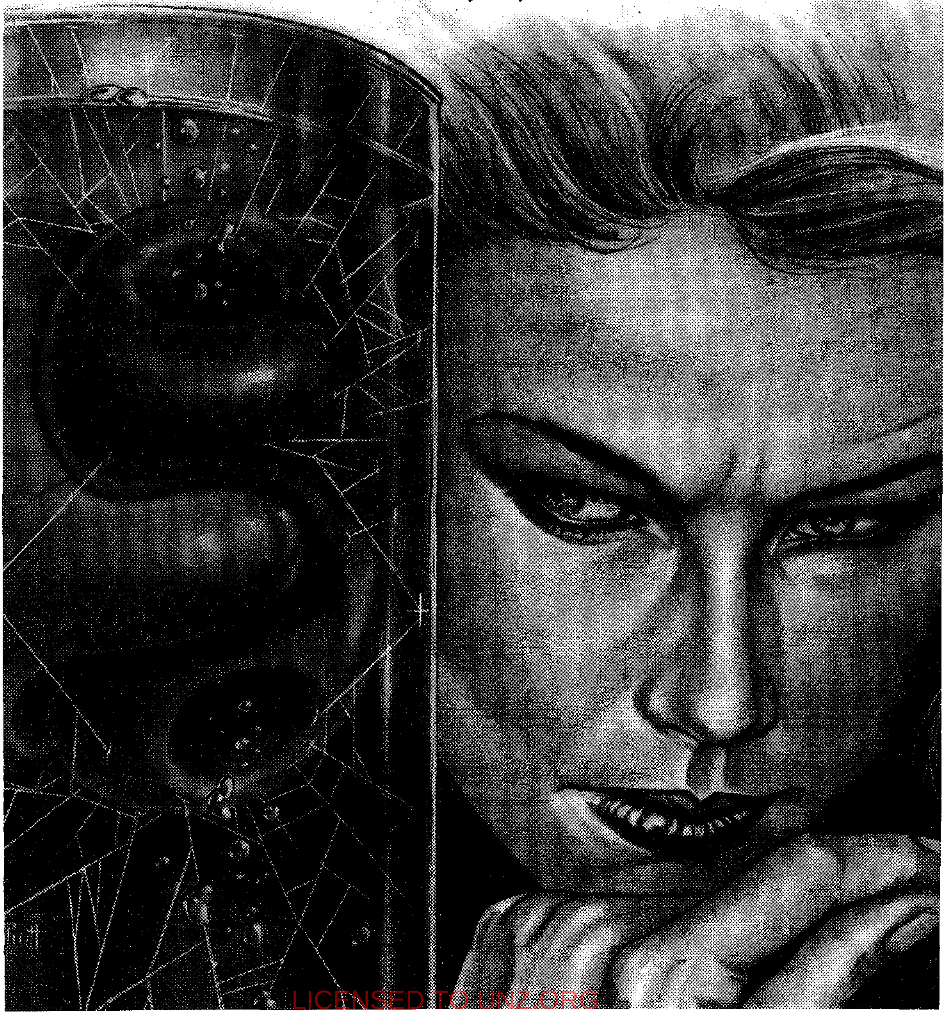
Any fool can make a rule, and every fool will mind it.
—Henry David Thoreau

Bill Johnson

MOTIVATIONAL ENGINEERS

The trick is to get people interested enough to do what needs to be done—and the operative word is "trick!"

Illustration by Darryl Elliott



"Today is our turn to show our products. And today we will discuss beverages."

Carolyn Sorenson sat at one end of the rectangular table. Urla na'Tydengh sat at the other end. A side table groaned under a rainbow of differently sized and colored bottles and cans. Plastic-covered sheets of paper filled with chemical specifications and volume price discounts were pasted to the side of every bottle and can. An assortment of clear shot glasses, mugs, and tumblers were spread out in front of the human.

"I will not discuss our space drive," Urla said firmly. "*That* is not negotiable. I want to make that clear from the beginning."

The alien was covered with soft blonde fur, thin and fine on the face and shoulders, thicker and longer and darker on the lower half of her torso and her short legs. Her arms were long and muscular, the hands deft and slender, with two opposable thumbs flanking five fingers. Her feet were wide and long and flat.

Her teeth were omnivorous, with both molars and prominent canines in a wide, thin-lipped mouth. Her nose was a shortened version of an elephant's trunk, and where humans expected eyes there were instead oval shaped black sensory pads. Her facial hair was short and trimmed and a narrow mane of longer hair ran from the crest of her rounded skull to the tip of her tail.

She wore an equipment belt and a vest with many pockets, each sealed with a hook and eye closure. A gold and diamond necklace hung around her neck.

Imagine a six-foot-tall kangaroo with an extra pair of arms and an attitude. . . .

"Of course I understand you can't negotiate about your space drive," Sorenson said smoothly. *Damn it!* "And I respect your position."

"Then we can discuss your beverages," Urla said, mollified. "Perhaps something there will have value as a trade item."

"There is no way to discuss them," Sorenson said. She reached over and took a dark green bottle and one of the pieces of paper from the side table. She took one of the empty glasses from in front of her. "Each one is unique, the product of centuries of refinement in one particular method of brewing or distilling. These are not simple fruit flavors, with alcohol added. These are art. Centuries and centuries of art. You cannot analyze these with a spectroscope and assign them a value. The only way to value art is to experience it. The only way to value these is to taste them."

"All of them?" Urla said doubtfully.

"All of them," Sorenson said firmly.

"This is one of our original drinks, from a place called the Czech Republic. The category is called beer," she said. "It's a fermented product, as you can see from the data sheet."

She opened it and poured a fine Pilsner Urquell into a glass. A white foam head grew, then stopped just short of sliding over the edge of the mug. Carolyn placed the glass and bottle together across from Urla. Urla picked up the data sheet attached to the bottle and read it.

"According to the data analysis, this is safe for me to drink," Urla said. She stopped for a moment and frowned. "The alcohol content seems rather high."

"An important part of the taste," Sorenson said. "And the Comparative Philosophies team reports you do drink alcohol."

"In certain religious rituals, yes," Urla said doubtfully. "I don't know that I've ever seen anyone drink it for pleasure."

"Then perhaps this will open up new avenues for trade," Sorenson said. *And perhaps I'll get you drunk enough to talk and not know what you're saying. The biochemistry team reported that alcohol affects you the same as us.*

"Perhaps," Urla said doubtfully. She picked up the mug then hesitated, halfway to her mouth.

"It seems so . . . antiseptic," she said innocently. "Whenever we use alcohol it's in a group religious ceremony. I don't think I've ever drunk it by myself. Perhaps you'll drink with me?"

Sorenson hesitated, then turned over a mug and filled it.

"Of course," she said. "No one likes to drink alone."

"Leave me alone. Let me die."

"You told her you never drank?" Detinla na'Tydengh said. "You told her no one ever drinks for pleasure?"

"You're going to remember this after I'm dead. You're going to remember how you tortured me and you're going to regret it and feel sorry for me."

"Feel sorry for you?" Detinla snorted. "I'm locked up with a team of humans who smell like my child after he hasn't bathed in a week, talking about religion until my mouth is sore and dry, while you're sampling exotic alien beer. I'm supposed to feel sorry for you?"

"Not just beer," Urla said. She smacked her lips together and stuck out her tongue. The inside of her mouth tasted like an old pair of boots and her tongue seemed to be coated white. "Distilled liquors. Vodka. Bourbon. And something called Scotch."

"Take a pill and get up," Detinla said. "Drink some water, wash your face, and I'll be back."

Detinla left the cabin and the hatch slid shut behind her. Urla closed her eyes, but that only made the pounding in her head worse. She opened her eyes, tasted her tongue again and made a face. Finally she levered herself up and off the bed and staggered to the washbasin.

"Hangover cure," she ordered. She looked at her face in the mirror and shuddered at what she saw. "Make that a double dose."

Two white tablets slid out of the dispensary. She swallowed them dry, gagged, then threw her head back and forced them down. She sat back down on her bunk and practiced deep breathing techniques.

By the time Detinla returned, Urla was ready to admit that while she felt terrible, she no longer felt quite bad enough to require ritual suicide. Maybe, just maybe, and for business only, she might live long enough to try one more drink. Maybe some of that Scotch.

"You'll live," Detinla said after she gave Urla a critical look. "Here."

Detinla tossed Urla a clean dress coverall. Urla looked up at her, puzzled.

"Word from upstairs," Detinla said, with a jerk of her head. "It's time to go faster. Your next session is scheduled for this afternoon."

"You can't hurry one of these," Urla complained. Her headache was a faded memory now, and more than anything she felt hungry. She slid out of her old, dirty coverall with the interesting stains and into the crisp new uniform. "They know that as well as we do. To come all this way and then fail because we get impatient is worse than a sin: it's damned wasteful."

"And we don't have so much raw material that we can afford to waste any of it," Detinla said. "Yeah, I agree. But they're not really rushing us. Comparative Philosophies is finished with the humans."

Urla finished dressing and stood. Detinla opened the hatch and they stepped outside Urla's cabin into the central dropshaft of the small scout ship. They fell gently to the lower level of the ship.

"What did you find? Can you make it work on them?" Urla asked eagerly.

"No."

Detinla shook her head. She looked depressed, dejected. Comparative Philosophies was successful more often than any other specialty, and Detinla was acknowledged as an expert. To admit defeat was not something she was good at.

"They've got everything I need," she said. "All the old legends, all the old beliefs. Angels and saints and heaven up above in the stars. And the cultural mores fit perfectly, with the ability to make a long term commitment to a goal and stick to it, for generation after generation after generation. You remember those pictures of the cathedrals?"

"The big churches over in Europe?" Urla asked. Detinla nodded.

"It took them hundreds of years to build those, back before they even had steam power or any kind of machine tools. The original architects were long in their graves before there was even a recognizable outline of a structure. And still they kept on building until they were finished," Detinla said.

"Impressive," Urla said.

Detinla shook her head.

"They have everything we need," she repeated. "A history of religious fanaticism as strong as anything I've ever seen in the textbooks. A history of hierarchical organizations that know how to put a plan together to attack a problem. And the ruthlessness to create and enforce the rules we need to solve the problem."

"So why can't we use religion?"

"Because they have too damned many religions!" Detinla exploded. "Usually I have trouble even finding one with the right specifications that I can work with, and here we've got hundreds, with a thousand splinter sects off of those. We've got religion on their newstapes. We've got religion on their video channels. Hell, we've even got religious preachers in the parks."

"And?"

"And none of them is worth anything," she said disgustedly. "We're too late. The old centralized religions that built the cathedrals and the pagoda cities and the pyramids are all gone, the religions that could focus the energy of an entire society all broken up. All these modern religions worry about is saving souls and doing good deeds and fighting with each other. That's useless to us."

"What about the preachers on the media?"

"Money. All they worry about is money," Detinla said. "No, I'm no good this time. I'll keep on talking with them to keep up our cover, but either you or one of the other teams will have to pull it off this time. If anyone is going to."

"You think we'll fail?" Urla said. She felt a familiar deep depression start again, and the great homesickness wash over her.

"I don't know," Detinla said, and shrugged. "We've failed before. But we must never give up."

"I've never been the solution before," Urla said.

"We've never met people this strange before."

"Today is our turn to show products," Urla said.

Sorenson sat across the familiar table from her, the rest of the human negotiating team in their chairs along the wall behind her. Urla was not sure of her ability to read human coloring and facial expression, but it seemed to her that Sorenson seemed more pale today, and the skin around her eyes darker. The eyes themselves were red and bloodshot.

"Do you feel all right?" Urla asked.

"Fine. Just fine. Everything is just fine," Sorenson said. Her smile was forced and fixed. *I'm fine, all right* she thought. *I might kill for a bottle of aspirin and eight hours of sleep, but I'm fine.* She looked across the table at Urla. *And damn those bastards in biochemistry. After all she drank last night she was supposed to have a hangover today. She looks just fine. And I feel like hell.*

Urla looked at Sorenson and allowed herself a secret smile. *Add hangover cure to the list of trade items,* she thought to herself. *And I hope you feel as bad as you look. That was supposed to be me, feeling like that, wasn't it? Well, sometimes biters get bit,* she thought spitefully.

"Sometimes our young are adversely affected after a religious ceremony," Urla said smoothly. "When we mature we have no problem with consuming any amount of alcohol. I'm glad to hear you are fine."

"Yes," Sorenson crisply. "Now, what do you have to discuss today?"

"Ah, something I thought you might find interesting," Urla said. She gestured and the drone set a shiny metal cylinder on the conference table, then slid silently back and out of the way.

"And this is. . . ?"

"Something suggested by the specifications you provided our biology department," Urla said. She touched the side of the container and it became transparent.

The cylinder was filled with a clear

liquid that filled the container almost to the top. In the center of the liquid, supported by a webwork of semi-translucent strands, was a dark red object, about the size and shape of two clenched fists held together. As Sorenson watched, the object pulsed in and out, first on one side, then on the other.

"It works in a liquid environment? Completely enclosed?" Sorenson asked.

"It works in a liquid environment," Urla said. She folded her upper pair of arms across her chest. She pushed a plastic sheet covered with specification numbers across the table to Sorenson. She picked it up, glanced at it, and handed it back to one of the engineers behind her. "If you expose it to air it begins to dry out and becomes useless."

"It's not very strong," the engineer commented. Urla glared at him.

"It's not supposed to be very strong," she snapped. "We met the specifications you gave us. It's designed for endurance and reliability, not power. The pump has no moving parts and will last one hundred years without a failure."

"Guaranteed?" Sorenson asked.

"Guaranteed," Urla said.

"How does it work?" Sorenson asked. She peered closely into the cylinder of clear liquid, the pump inside.

"It's an electrically sensitive gel," Urla explained. "When a current crosses it, the gel shrinks. When the current goes away, it expands."

"All at once?"

"No, it's localized. Your specification showed four pumping chambers, each of which contracts and expands separately, but in sequence," Urla said. "We built this to duplicate that function exactly."

"The gel is chemically neutral?" Sorenson asked.

"Completely neutral," Urla said.

"We have to test it," Sorenson said.

Urla heaved herself upright, tail tucked discretely behind her.

"Of course," she said. "If everything is satisfactory we'll sell you all the manufacturing specifications and development samples."

Urla turned and left the room. Sorenson studied the pump in the display cylinder.

"So what do we do with it?" the engineer asked. He waved the specifications sheet at her. "We've got better and stronger pumps that will last just as long. There's no way this can be used in an industrial environment."

Sorenson continued to stare at the pump, fascinated by the slow, steady beat.

"You're a good engineer, Harry, but you think in black and white, in straight lines."

"I think like an engineer," he said.

"Exactly. Which is why I'm in charge of this negotiation," Sorenson said. "Don't think pump. Think heart. The fully implantable artificial human heart. . . ."

Excerpt, *UN-Tydengh Economic Negotiations report, Dr. Carolyn Sorenson, Chief Negotiator, Blue Box report, General Secretary Eyes Only:*

". . . Economic opportunities for human business in the interstellar market appear great. Tydengh negotiators have purchased large numbers of samples of various Earth products, including ceramics, textiles, process control equipment, and distilled liquors (particularly Scotch). In return we've received various high technology goods, such as a fully implantable artificial human heart. . . .

". . . The one item the Tydengh have refused to sell is space drive technology. Intelligence operations have also been unsuccessful. . . .

"Conclusion: Human products have a potentially huge interstellar market. We cannot, however, get our products to market except through the Tydengh. This limits our commercial opportunities and the profit potential of the market. Unless and until we develop our own space drive.

"Proposal: this office has been contacted by representatives of members of the Security Council, as well as Japan, Germany, India and other major industrialized powers. As per your instructions we have provided them access to our reports to you. The unanimous response has been a desire to combine technologies in a space drive development effort. Our analysis supports this effort. . . ."

Urla sighed almost like a human when she was safely aboard her ship. Earth hung above her, a mottled blue and white and brown ball. The space station called Orbital Watch One floated next to the *Kreela*. The radar detector on board the *Kreela* glowed a pulsing yellow-orange, each radar impulse that reflected back to the humans indicated by a single flicker.

"Well?" Detinla asked.

Urla closed her eyes for a moment, and took a deep breath. The familiar odors of home, the deep, musty smells she'd missed so much on Earth, seemed to roll up her nose and into her brain, and wash outward over her entire body. The closest she'd come to this on Earth was the day her trade delegation visited a farm and she lingered, alone for just a minute, in the hog confinement building. She hadn't even realized she was homesick until then.

And now.

She opened her eyes and smiled.

"If we do our last part correctly, then, yes, we will succeed," she said. "They are almost ready to build a cathedral. But they need just a little more convincing."

"Good," Detinla said. She turned back to the control board while Urla strapped herself in front of the communications console.

Urla checked the clock and the latest messages from the other four ships. She sent out a synchronization signal to the ships, scrambled to sound like random solar radiation, and waited impatiently while the signal and replies crawled out and back at the speed of light.

"I've got departure clearance from the humans," Detinla said. She touched the keyboard and the *Kreela* began to drift away from Orbital Watch One.

"We're synched up," Urla said, as the last acknowledgment signal came in from the distant ships. She touched her own keyboard. "Timing signal sent. We're committed."

Detinla was busy with her controls. The *Kreela* accelerated away from the space station. Timing was everything. The *Kreela* must position itself so Orbital Watch One was the only station that could observe them, and then dip out of sight for exactly eight seconds.

"We finally got a signal from that probe we sent out to the star the humans call Tau Ceti," Detinla said conversationally. She kept her voice low and calm, but they both knew the entire mission depended on the next ten minutes. Detinla forced herself to keep her hands still and off the keyboard, the entire mission now under the control of the ship's computer, but her eyes still flickered from one indicator to another.

"What did it find?" Urla asked. She was busy linking, secretly and unobtrusively, into the human computer network.

"Our next target species," Detinla said.

"Intelligent?"

"Very."

"What do they look like?" Urla asked.

"Larger than us, and they're water breathers. Slick skinned and talkative. Big noses. Imagine Earth dolphins with hands and fire," Detinla said.

"Fire? Aquatic life with fire?" Urla asked.

"Unique," Detinla agreed. Urla felt the old stirrings of hope.

"A new point of view," she mused. "They could be the ones."

. . . To go home again, faster-than-light. Not the slow plodding of a sub-light ship, strapped in suspended animation, but free, free to fly, free to go home to go home to go home. . . .

"What about the humans?" Detinla asked hopefully. "Could they be the ones to discover faster-than-light travel?"

"Perhaps," Urla said thoughtfully. "I've never met a race that thinks so much about profit. If they believe something can be done and it will make money, they'll do it. And you know how stubborn they can be."

"You convinced them of the profit potential?" Detinla asked.

"Oh, yes," Urla said. She remembered the look on the faces of the humans as she made her purchases and her sales.

"Oh, yes, I convinced them of the profit potential," she said.

"Good. Then it's my turn to convince them again that we can go faster-than-light," Detinla said.

"Get ready."

"Now!"

Urla checked her tap into the human radar net. Their radar showed *Kreela* was still in orbit, several thousand kilometers away from Orbital Watch One. The radar detector blinked a regular orange-yellow with each radar pulse.

Then another *Kreela* appeared on the human radar net. But this *Kreela* was eight light-seconds out from Earth.

It disappeared.

Appeared.

Now *Kreela* was six light seconds out, the radar image told the humans. Gone. Appeared. Four light-seconds out. Gone.

Appeared. Two light-seconds out.

Gone.

"Now!" Detinla said. She slapped the controls and brought the *Kreela* up so that, for just a split second, the ship showed even more clearly on the human radar net.

Stealth shields snapped into place. Urla watched the *Kreela* disappear from human sight and their radar net. As far as Earth was concerned, the *Kreela* was gone. Urla remembered her training lessons.

. . . A faster-than-light signal will outrun a lightspeed-based detection system. Based on this fact, a faster-than-light speed ship will appear to be boosting out away from the detector, when it's really coming in, toward the detector. And a faster-than-light ship will appear to be boosting in, coming toward the detector, when it's really going out. . . .

"Did they see us leave?" Detinla asked. "Did they get through the screens?"

Urla adjusted the controls. There was no sign of the *Kreela* or the other four duplicate ships on the human radar. As far as Earth was concerned, the Tydengh ship, the one and only Tydengh ship they had ever seen or been told existed, had just departed Earth using its faster-than-light space drive.

"They saw us leave faster-than-light," Urla said. "They didn't see us after that."

Detinla looked smug and activated the course setting, stealth shields on full. Urla sent out another disguised signal and waited patiently for the replies to crawl back to her. She felt the comfortable pressure on her back as Detinla turned the thrusters on and headed for the rendezvous with the other ships and the main vessel past Saturn.

"A fresh point of view," Urla said. "That's all we need."

"Do you really think so?" Detinla asked, her face a picture of post mission depression. "We've been trying for a thousand years to build a faster-than-light drive. We've failed."

"And we've reached a dead end," Urla said. "We've tried to build our own cathedral, but we can't finish the design. But someone, somewhere, will solve the problem. If they have a motive to solve it."

"And that's our job," Detinla said.

"Yes," Urla said. "We're the motivational engineers."

She unstrapped herself and padded back to the cargo hold. She opened it and stared, appalled, at all the Earth merchandise she'd bought. She thought of all the hours she'd spent arguing and haggling over price, just to make the humans believe their merchandise had value. That there was a market and a profit to be made.

"What are you going to do with all that junk?" Detinla asked. "We can't haul it all the way to Tau Ceti."

"Drop it outside the Oort cloud," Urla said decisively.

"Except for the Scotch. I rather liked the Scotch. . . ." ■

ULTRA-ENERGETIC COSMIC RAYS AND GAMMA RAY BURSTS

The two most important unsolved basic problems in astrophysics today, in my opinion, are (1) the origin of ultra-high energy cosmic rays and (2) the origin of gamma ray bursts, (see my 10/95 AV column). Now there is some new evidence that these two phenomena may be related. This column is about that possible cosmic connection.

Cosmic rays have been a standard if mysterious phenomenon in astrophysics since the 1930s when experimental physicists first began to detect charged particles with Wilson cloud chambers, Geiger counters, and other electronic detectors. They found that energetic particles were detected even with no radioactive sources nearby and inferred from the angles of tracks in the cloud chambers that these particles were coming from the sky.

Those detected particles are now called *muons*, a heavyweight lepton cousin of the electron. They were produced when a primary cosmic ray, probably a very energetic proton, hit the upper atmosphere and produced a shower of thousands of secondary particles, which in turn showered to produce more particles, and so on. At the end of this upper atmosphere production chain are the muons.

The muon decay half-life at rest is only about two microseconds, sufficient time, moving at the speed of light, to travel only 600 meters (2,000 ft). Clearly 600 meters is not enough travel distance to reach the ground from the upper atmosphere. However, cosmic ray muons receive a "life extension" from the relativistic time dilation of their near-lightspeed velocities, allowing them to travel all the way to ground level before they decay. These atmosphere-penetrating messengers first carried the news to physicists on the Earth's surface that cosmic rays exist. Cosmic ray muons continually bombard our planet from space and are a significant contributor to the bath of ground-level radiation in which we all live.

Over the intervening decades since the discovery of cosmic rays, we have come to understand that space is a radiation-rich environment. Solar flares, supernovae, and binary star systems with a black hole as one binary member, all produce floods of X-rays, gamma rays, and energetic charged particles that—with space-based imaging detectors—we are able to detect, localize at their source, and study. The source and production of the highest energy cosmic rays, however, remains a mystery.

Until recently, the detection of ultra-energetic cosmic rays was limited to a rather low maximum energy sensitivity because of a basic fact of detector physics: the higher the particle energy, the larger must be the detector that measures its energy. The most energetic cosmic rays have far more energy than particles from our largest particle accelerators, and their detectors must be of heroic proportions involving huge sensitive volumes and many tons of detector material.

In principle, the best place to study primary cosmic rays is in space, avoiding atmospheric showering and measuring the primary particles directly. However, the requirement of very large detectors has so far forced space-based measurements to concentrate on relatively low energy cosmic rays. During the past decade, however, ground based experimenters have devised another strategy to deal with the detection problem. They have begun to use the Earth's atmosphere itself as the sensitive volume of the detector.

An example of this trick is the Fly's Eye detector, which has been constructed by University of Utah astrophysicists and co-workers at the Army's Dugway Proving Grounds. The Fly's Eye is a very large array of searchlight-like mirrors and photomultiplier tubes which literally watch the sky, looking for light flashes. When a primary cosmic ray hits the upper atmosphere and showers, the flood of very energetic charged particles produced there makes Cerenkov radiation, a bright and highly directed flash of visible light. The Fly's Eye, so named because it operates like the compound eye of an insect, collects this light from the Cerenkov flash, permitting the Fly's Eye analysis group to deduce the energy and direction of the primary cosmic ray.

On October 15, 1991, the Fly's Eye group observed a primary cosmic ray that would win a gold medal as the most energetic cosmic ray event ever recorded. The measured energy of this event was about 3 x 10^{20} electron volts, and its direction in space was localized to an angular "box" about 1 degree by 10 degrees in the sky.

The energy of the primary cosmic ray particle, presumably a proton, that produced this event is amazingly large. It hit the atmosphere with a total kinetic energy, converted to SI units, of about 5 joules. This is a truly enormous macroscopic quantity of energy, enough energy packed into a single proton to lift a one kilogram mass (2.2 lb) by half a meter (20 in) against the force of gravity! The second most energetic cosmic ray ever recorded, the runner-up and silver medal winner so to speak, had an energy of about 2 x 10^{20} electron volts and was detected by the Japanese AGASA experiment in December 3, 1993 and localized to a 1 degree error circle in the sky. There have also been earlier reports of a few cosmic ray events with energies that approach the 10^{20} electron volt range, and we can expect more as detector technology improves and larger detector arrays are constructed.

The enormous energy of the Fly's Eye and AGASA cosmic ray events is perplexing because the Universe has a built-in energy barrier, the 2.7 K black-body photons from the Big Bang, which systematically slows such ultra-energetic particles. Microwave background photons are the most abundant particles in the Universe, and they fill all of space. When an energetic proton moves with an energy of 3 x 10^{20} electron volts, its collisions with these photons can be violent enough to make nuclear reactions involving pi mesons. This collision process will slow down ultra-energetic cosmic rays until their energy drops to below about 10^{19} electron volts. From this we know that the rare 10^{20} electron volt cosmic rays that are being detected cannot have traveled very far through the cosmic microwave background radiation and must have been produced somewhere in our galactic neighborhood, no more than 100 million parsecs (330 million light years) away.

Part of the puzzle of these super energetic cosmic rays is that there are no prominent astrophysical objects in the right directions in space and within this distance that might have produced them. Another problem is that it is extremely difficult to conceive of any natural mechanism (or any artificial mechanism, for that matter) that could accelerate a particle and give it this much energy.

Recently Waxman at Princeton University, and Milgrom and Usov at the Weizmann Institute of Science in Israel, have independently hypothesized a possible connection between these particles and another astrophysical mystery, gamma ray bursts. As described in my 10/95 AV column, gamma ray bursts were discovered accidentally by military satellites placed in orbit to detect possible Soviet nuclear weapons testing in space. Gamma ray bursts (GRB) occur at the rate of about one per day, probably originate a cosmological distances well outside our Galaxy. If the gamma rays are emitted uniformly in all directions at cosmological distances, GRB represent a net energy release of something like the total mass of the planet Jupiter converted directly into energy.

Waxman suggested that whatever produced the primary cosmic ray might have made a burst of gamma rays at the same time and demonstrated that the detection statistics are consistent with this idea. Milgrom and Usov also considered these statistics and studied the extensive catalog of gamma ray bursts that has been provided by the BATSE experiment and others, attempting to match them to cosmic ray events. They reasoned that photons (i.e., gamma rays) from a given burst source will arrive earlier than charged particles (i.e., primary cosmic rays) because small magnetic deflections in the path of the charged particle in the intergalactic magnetic field will slightly increase its path length. They calculated that over the several hundred million years the primary cosmic ray was in flight, this effect could have produced a net time delay of a few months to a few years. Therefore, they searched the data on GRB for events coming from the same region of sky that arrived some months before the Fly's Eye and AGASA events.

And they found what they were looking for. They discovered that on May 3, 1991, 5.5 months before the Fly's Eye event, the BATSE experiment and several other GRB instruments recorded the brightest gamma ray burst event in the BATSE catalog, and this event matched the Fly's Eye event very well in angular position. The GRB event included one gamma ray with a measured energy of 10 GeV, an extremely high gamma ray energy.

The case for the correspondence of ultra-high energy cosmic ray with GRB is less compelling for the AGASA event, but Milgrom and Usov found a GRB candidate, a strong burst detected by BATSE on December 30, 1992, about 11 months before the AGASA event. The sky position of this GRB agrees with the AGASA event to within the 4 degree systematic angle-uncertainty of the BATSE experiment. This GRB is only 1/7 as strong as the GRB correlated with the Fly's Eye event, but its energy is among the strongest 10% of the GRB in the BATSE catalog.

Because there are only two ultra-high energy cosmic ray events that could be treated with the Milgrom and Usov technique, these results are very suggestive but not conclusive. Nevertheless, the work provides a strong suggestion that the two most mysterious phenomena in astrophysics may have the same source.

Some unknown something somewhere in our Universe is pumping many joules of energy into single particles and loosing them on the Universe. The leading mechanism for accomplishing this feat, the so-called Fermi-mirror acceleration process, is not plausible because it would require a particle with an energy of around 10^{20} eV to be repeatedly reversed in direction during the acceleration process. But if we reject Fermi's mechanism, we are left with no other alternatives.

How could anything in our Universe produce such energetic particles? And if something did, why (with the possible exception of gamma rays) do we see no other evidence of the acceleration process in the form of radio waves, infra red, visible light, or X-rays? Waxman and Milgrom and Usov, and Waxman may have combined two mysteries to make one, but that one remains a very deep mystery indeed.

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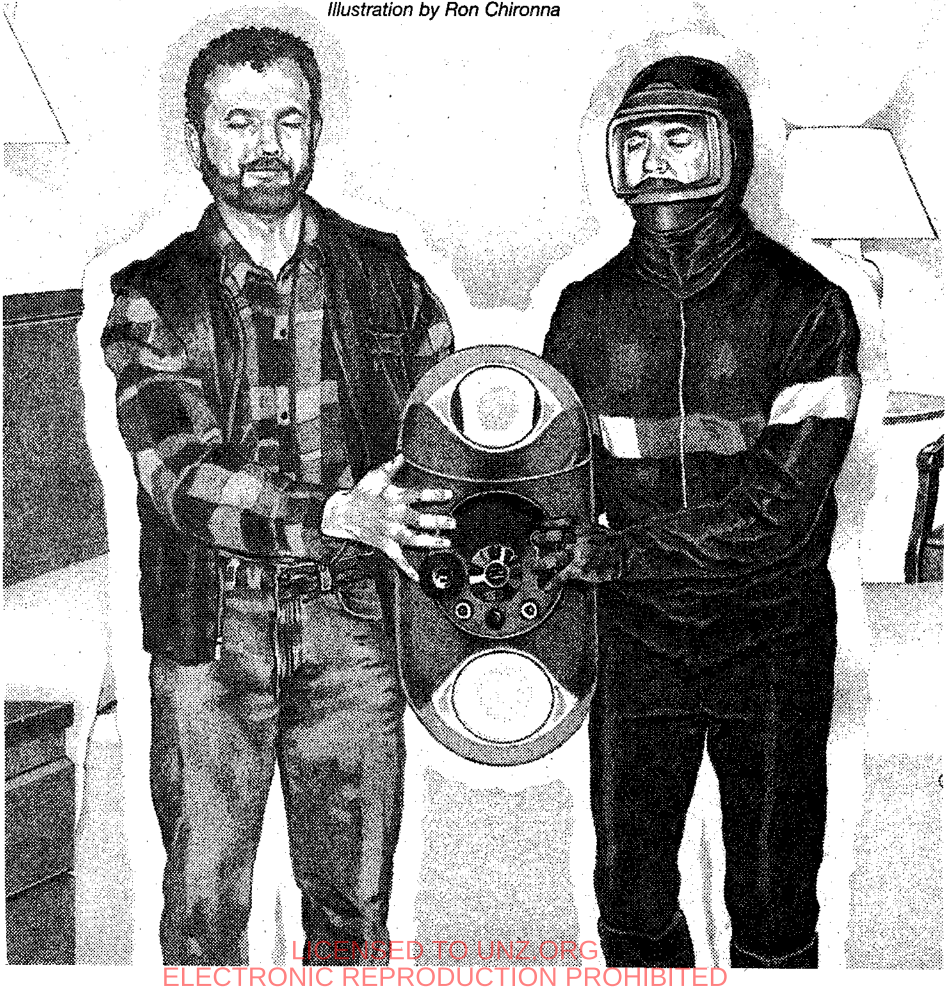
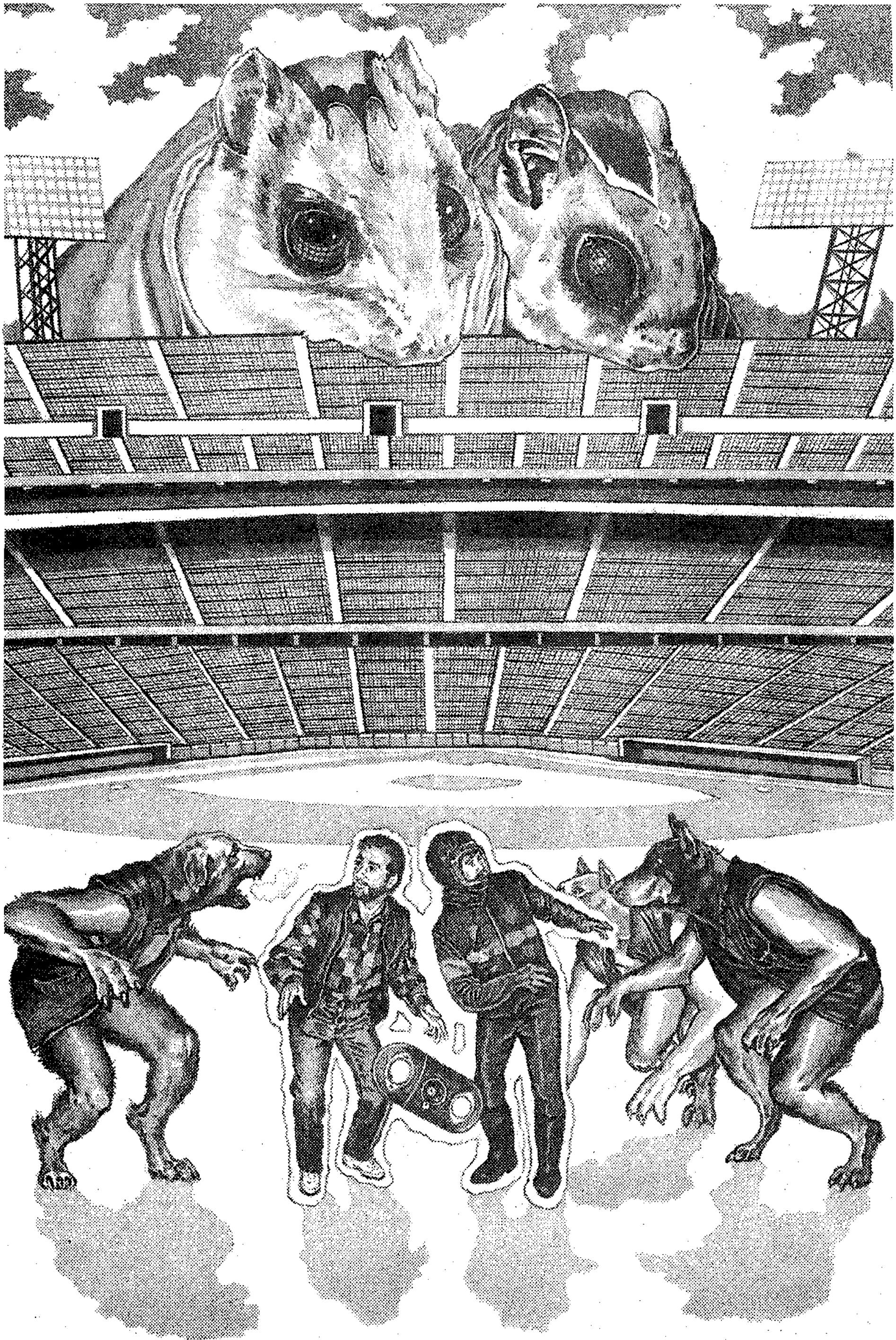
Daniel Hatch

LAST STOP ON THE GREEN LINE

Contact with a more advanced civilization can be an overwhelming experience. But if you understand that when it starts. . . .

Illustration by Ron Chironna





The snow in Harvard Yard was a foot deep, and Harry Simpson was up to his knees in it.

And up to his hips, his shoulders, and his neck. He realized without shock or surprise that he was lying on his back in the middle of the icy confection.

He opened his eyes and looked up at a sharp blue sky framed by the wall of Memorial Church and a row of low shrubberies.

A moment passed before he remembered the party. It was one of those on-line dorm affairs where everyone talked to each other through their think-man, so no one paid much attention to a twenty-six-year-old public service student like Harry Simpson, allowing him to drink far more than he should have.

And on the way home, the yard in front of the church had seemed as inviting as his own bed and much, much closer.

The shrubs had shielded him from view of passing students and the campus police, and his rik-suit had saved him from freezing to death. The Rik-technology garment that had been the fashion rage a year ago was now hopelessly out of style, but it still served its purpose.

A cold wind nipped at Harry's face as the bell in the spire began to ring, and the wind rasped across his cheeks, reminding him that it was still February.

He counted the pealing of the church bell, hoping to determine the time without actually looking on-line. He stopped when his count reached thirteen. That was close enough, he decided.

Then he noticed the quiet.

Not quiet outside, where the church bell echoed off the Harry Elkins Widener Memorial Library and Emerson Hall and the rest of Harvard Yard, but quiet inside. Inside his head.

His think-man was off-line, he realized with a start. For the first time in days as far as he could recall—with the exception of his cybernetics and philosophy class with Professor Epstein. The faint menu shimmering in the air was gone. So was the gentle pressure of the virtual mouse in his hand. And there was no soft whisper filling his ears with information at the moment of command.

"Instant access to unlimited information is not the wonder it would first seem to be," Professor Epstein had said often enough, her eyes glaring with mystic intensity. "If you don't know what to do with that information, then it is a waste of technology and a waste of a potentially useful mind. One of the reasons you have mortgaged your futures to attend this university is to become accustomed to doing more than drowning yourselves in a flood of data. And that is why you cannot enter this classroom without unplugging."

For most of his classmates, that had been a difficult exercise. They found themselves stammering as they tried to form sentences without cybernetic assistance, answer questions that called for judgments instead of the quick recitation of facts and figures provided by a computer somewhere across the river, and generally pretend to be more human than they had learned to be in their short lives.

With the exception of the Rik students, of course. Their race had grown up with the technology and knew how to handle it.

And, on occasion, with the exception of Harry Simpson, who had spent six years in public service, planting forests in the Pacific Northwest and earning enough credits to get to Harvard in the first place and learning to think for himself long before the price of the think-man had dropped to a level even he could afford. Or so he liked to think.

He remembered now that he had switched off-line shortly after falling backwards into the snow. The think-man had been too noisy, lecturing him about the life expectancy of an exposed human being lying on the ground in the middle of February in the middle of the night in the middle of Harvard Yard.

The church bell stopped ringing, and Harry became aware of the sudden rise in the level of noise around him. Voices, footsteps, and the commotion of changing classes.

He turned his head to glimpse the parti-colored parade through the bushes. His head punished him for his escapade of the previous night by throbbing and spinning.

There was no choice now but to follow through—or lie here and risk suffering the fate of pathetic rock musicians of the last century.

He rose to his feet in one swift motion, trying to outwit his protesting sense of balance. It worked, after a fashion, and he pushed through the shrubs to the sidewalk where students thronged and the occasional professor tried to keep a steady course against the current.

Cambridge was a company town where the major industry was sophistication, so everyone tried to look sophisticated. Sometimes they were just faking it, but sometimes they weren't. Harry remembered the night he had wandered into a seminar on foreign policy and extraterrestrial trade. The lecturer had been Elsie Hays, the government's Extraterrestrial Trade Representative with the Riks.

He opened his rik-suit, exposing himself to the bitter winter chill for a moment, and switched on his think-man. The reassuring murmur of faraway voices returned to his ears, the menu flickered to life at the edge of his vision, and he could feel the virtual mouse in his hand once more.

Though he wouldn't admit it to his classmates, this was his way of belonging to something larger than himself. He just didn't feel comfortable joining their team. He had learned too young how to be a loner. But he didn't feel comfortable without belonging to something, and this was it.

"Thank you for using MRI On-Line Systems," the voice in his ear said. "You have seven messages in voice-mail."

"Victoria!" he cried out loudly, smacking himself in the forehead with the palm of his hand. He squeezed the mouse and the main menu appeared before him—complete with a digital clock that told him he was more than an hour late for his date with Victoria Anne Dickinson.

The voice-mail was from her. All of it.

"I'm waiting, Harry dear."

"I'm still waiting, Harry."

"Harry, it's been half an hour."

"Mr. Simpson, I do not appreciate being embarrassed like this."

"Where are you, Harry?"

"If you're not here in five minutes, Harry, you can forget about it."

"I'm in the Science Center and you have exactly five minutes—until 11:05 A.M.—to get your trash over here."

With about ninety seconds left before her deadline, he dashed down the lane, ducking across the path of a Campus Police security cart and nearly clipping the rearview mirror. He narrowly avoided plowing into a pack of Riks—who resembled meter-tall gerbils with insect-like compound eyes—as they passed through the gate into the Yard. And he stopped short only a few inches from Professor Epstein as she stepped out from behind a concrete planter.

"Mr. Simpson!" the professor said without a gasp, her gray eyebrows arching towards the wool cap she had pulled tightly over her head. "One of the drawbacks of that infernal machine in your brain is that it interferes with your concentration and turns you into a menace to pedestrians."

"I'm sorry, Professor," he said quickly, turning around and walking backwards away from her. "I'm late. I'm late—for a very important date."

The professor cocked a dubious eyebrow at him, shook her head, and continued on her way.

Harry dashed through the doors of the Science Center, past a bulletin board plastered with flyers and notices, and up the concrete ramp towards the fern-filled restaurant with its vegetarian treats and hungry students.

And there was Victoria, standing at the top of the ramp, waiting, wearing knee-high black boots, a long red coat that reached nearly to her ankles—with black buttonhooks undone from about mid-calf—and a fierce expression that she wielded like a weapon powerful enough to melt holes through lead—a weapon aimed directly at him.

"It's about time," she said as he skidded to a stop before her. She reached out, put a hand around the back of his neck, pulled his face down to hers and kissed him long and hard.

Victoria Dickinson was self-centered, demanding, stubborn, occasionally rude, always spoiled, and smarter than most of her classmates.

Part of that she'd inherited from her father. He was the ambitious, self-made entrepreneur who had amassed a fortune by importing as much Rik technology as the government would allow—the think-man, rik-sacks, rik-suits, and new things that no one even knew about yet.

Another part of it was her age. Like Harry, she was older than most of her classmates. She'd spent a year at Wellesley before tiring of it and taking off on a tour of the world—at her father's expense, of course. Four years later, she'd returned. Wellesley wouldn't take her back, but by then she was able to attract the attention of the admissions office at Harvard.

Their relationship was one of cold

passion. She wanted sex. In fact, she demanded sex. But she offered little love in return. And no romance. Mostly she offered a casually domineering manner that she had either learned or inherited from Daddy.

Harry put up with it. He told himself that he could walk away any time he wanted. Most of the time he believed that. He had found a place inside himself that was unaffected by her demands and unbothered by her psychological battering. And in return he had a rare opportunity to observe an example of extreme human character close up.

It wasn't as if he could see some spark of girlish innocence in her, some sensitive bit of unprotected humanity. There was none of that.

It was more the ghastly fascination felt by a bystander at some horrible accident. He didn't necessarily want to look, but he couldn't turn away.

And there was always another surprise waiting around the corner.

But he knew that sooner or later they would come to a parting of the ways—before he allowed her to consume him like a black widow spider or a praying mantis.

Victoria released him and drew back.

"You taste awful. What have you been doing?"

He began to answer her, but she interrupted.

"Never mind. Hurry up and come with me. I have to get to class and there's something you have to do." She handed him her rik-sack—which was not larger inside than out, as some confusing ads said when it came on the market, but lighter full than empty—and took off down the ramp, her boot heels flopping against the concrete floor.

They stepped back into a February chill leavened only slightly by a bright midday Sun. Winter in New England was cold again, now that the greenhouse effect had been reversed. Harry looked up at the sky, unconsciously tuning in to a weather report.

"The temperature is 22 degrees Fahrenheit," whispered the voice in his ear. "The wind chill is 5 below zero. Forecast for this afternoon is sunny and continued cold and windy. Tonight's temperatures will be in the single digits."

The wind plucked at homemade banners strewn across the ivy-covered bricks of the Harvard dorms. "Freshman Social Feb. 23," proclaimed one. "Rik Student Society looking for you!" said another, with an ominous ambiguity.

A cleanup team was working its way across the snow-covered common, collecting litter, sweeping the snow from the walk, smiling at the passersby. Even Harvard had become infested with the self-appointed groups of civic-minded youth that seemed to pop up simultaneously all over the place. Harry thought they were a poor substitute for the work crews he'd been on when he was doing his PS. Besides, the university paid people to do that kind of thing. These kids would be of more use if they joined the Democratic Activist League.

A small handbill stuck to a lamppost caught Victoria's attention. She stopped abruptly, stepped over to the lamppost, ripped the flyer down, came back, and stuffed it in Harry's hand.

It said simply: "WE'LL PAY YOU TO TRAVEL."

"This is where I want you to go."

"Is this a subtle way of telling me to get lost?"

"That's not funny," she said, frowning as she continued down the walk. "This is serious. I want you to go there today—before lunch. Sign up for the tour of Naverly Tol. There's only one a day and they still have a seat open."

He read the small print at the bottom of the sheet. The offer of cash for travel was made by Getaway Tour Guides. Harry fingered his virtual mouse, flipping through menus until he found a directory of campus organizations. He rolled up to "Getaway" and squeezed hard.

"Getaway Tour Guides is a travel guide publisher started several years ago by Harvard students and continued by them after graduation. They pay students to travel to exotic locations in return for written reports on travel arrangements and tour highlights. The reports are used in travel guides, both hardcopy and on-line. Offices are located in the Brattle Building, Harvard Square, Suite 211. For on-line link, return to menu."

"Naverly Tol? Where is that?"

"Somewhere on the other side of the Galaxy, I suppose," Victoria said. "It hasn't been discovered yet by the tourist crowd."

"And you want me to go there?"

"It's important," she said. "I'm doing it as a favor to Daddy. You only have to be gone overnight."

"Are you going to tell me why?"

"Later, darling. After class, I'll tell you all you need to know." Their walking had carried them up to the doors of Emerson Hall.

Emerson—like many of Harvard's aging structures—had always reminded Harry of a theme-park for historians and scholars. It was centuries old on the outside, but sparkling new on the inside, just like something built by Disney, complete with electronic blackboards and think-man jacks at every desk.

"Now kiss me quick and get going. If you hurry, you can walk me to the library when class is over."

He obliged her and then stepped back. She didn't even look up, but turned quickly and rushed through the doors.

Harry sighed, then headed for Harvard Square.

Harry Elkins Widener was a Harvard graduate who'd had the grave misfortune, at the age of twenty-seven, to purchase a ticket on the maiden voyage of the White Star liner *Titanic.* He was not one of the lucky ones who survived.

In his will, Harry had left his not inconsiderable private collection of books to his alma mater, to be held by the executor of his estate, his mother, until a suitable place could be found for them. She had taken care of that duty, and now the more than three thousand volumes of his collection filled the shelves of a small, wood-paneled study with a fireplace at the far end, furnished with a few antique sofas and easy chairs and a mahogany desk.

The room was surrounded by a larger library, also provided by Harry's mother, which was smaller than the *Titanic*, but not by much.

Mrs. Widener had also required that every student at Harvard be taught to swim before being allowed to graduate.

Victoria thought the smaller library was a perfect place for a confidential conversation.

"Did you take care of everything?" she asked.

"Every last detail," Harry said, displaying his copy of the transit ticket and a thick book on Naverly Tol that he had picked up at the Globe Map Shop.

"What's that?" she asked when she saw the book. "Never mind. You won't need it."

"What about the Getaway tour guide?" Harry asked, scrambling to avoid having his feelings bruised by her automatic rejection of his preparations.

"What about it? You don't think you're going there just so you can write some silly guide for bored tourists, do you?"

"I guess I don't. Exactly why are you sending me to the other end of the Galaxy?"

"When you get to this place—"

"Naverly Tol."

"Whatever. When you get there, you will be contacted by someone."

"Human or alien?"

"Don't ask questions. You'll know when they make contact. When they do, they will give you something. Something very valuable. That's all you need to know right now. You are to bring it back to me. Understand?"

"Simple enough. If nothing goes wrong."

"Nothing can go wrong, Harry. Trust me. This has all been worked out. There's no room for error."

Harry kept his doubts hidden. The more he went along with her, the more skeptical he became. Obviously there was much going on here that Victoria wasn't telling him.

There was a lot going on that he wasn't telling her as well, so in a way he felt they were even. But he was beginning to realize that just as there was no reason for her to trust him—whether she knew it or not—there was no reason for him to trust her.

"Is that a promise?" he asked.

"You have my word on it," she said, with a glint in her eye that left Harry certain that her word was worth about as much as Harry Widener's ticket to the *Titanic*.

While the Rik had arrived in Earth orbit in great starships that burned in the night like distant beacons, their preferred mode of travel was the transit line: instantaneous transmission of matter across the vast emptiness of interstellar space. It was much easier once you had a transmitter and a receiver in place at each end.

The station for Boston was out in Riverside, at the far end of the Green Line on the T. And in a way, Earth itself was like that trolley stop—the last station on the end of this line for decades to come.

It took nearly an hour to make the

ride to that last stop. And it took a couple more to pass through the succession of transit stations between Earth and Naverly Tol.

Eventually, Harry stood a hundred meters from the edge of a great canyon under a flawlessly clear blue sky. The gash in the ruddy desert plain dropped away from him, yellowish brown around the edges and rusty red in its depths. A dry channel carved its sinuous course through the bottomland, its twists and turns magnified and amplified into the wide expanse of the canyon walls.

A single twisted skeleton of a long-dead tree clung to the stone in front of him. The plastic structure of the transit station stood behind him.

This was Naverly Tol.

An automated aircar appeared from behind the Rik building, collected its single passenger, and flew off over a stark and lifeless plain. It deposited Harry after a short flight on a piece of gravel and sand that appeared as arbitrary as it was colorless.

According to the book he'd bought at the Globe, the inhabitants of this world had done this to their planet themselves.

"An ecological disaster of the first order has occurred here within historical time," Professor Melville Grant had said. "All their subsequent culture is a reaction to this disaster, which must have occurred over a very brief interval. The shock waves of planetary destruction can be found in the patterns of the Tolian culture, in the pathologies of the Tolian character, and in the constant, ceaseless trek that the Tolians have set themselves upon since the collapse of their natural habitat and the consequent destruction of their technological civilization. . . ."

Harry had gone over that part of the book six times, starting over and over again each time he was interrupted. He'd never gotten much farther.

The arid wind sucked the moisture out of his body despite his rik-suit, and the windblown grains of sand stung his face.

The Tolians began to appear within a few minutes.

The first one came alone. It wore a tunic over a spherical body with a wide belt around its middle. A conical head sat atop a long, flexible neck—with large, bulging eyes at the end of straw-colored stalks that sprouted from the top instead of hair. The thing had no chest, just an abdomen. Its legs bent backwards at the hip and knee joints, which were as large as grapefruit—either it had some form of arthritis or a complete set of ball-and-socket joints from one end of the limbs to the other. The elbows and shoulders looked the same. Its wide splayed feet were wrapped in rough-spun cloth. Its oversized hands had too many digits to count.

"Hello," Harry said.

The Tolian stopped twenty meters away, tilted its eye stalks up and down to inspect the tourist from Boston, then continued on its way without making a sound.

A second Tolian arrived a few minutes later, pulled a tube from a pouch, put one eye to it, and scanned the horizon. A moment later, another Tolian ran up from the south and gobbled loudly.

"Water hole four kilometers to the southeast," said the voice in Harry's ear.

"Thank goodness for small favors," Harry said to no one in particular, grateful for the Rik translation program.

"Blessed eating," said the first Tolian.

They ran off towards the west.

The next to appear was a group about a dozen strong. Every few meters, they would stop and one of them would dig in the sand with what looked more like a large spoon than a shovel. After a bit of intense work, the digger would make a loud exclamation and leap up holding a bit of vegetation or a wiggling bit of wildlife, then rush over to one of the large baskets they carried.

They, too, ignored Harry, but by now he'd gotten used to it. At least they didn't try to put him in a basket.

"You all must have gone to the same school," he called after them, softly so as not to attract their attention.

At long last, after a couple of obvious hunting parties came by, carrying their game lashed on long poles, the main party appeared.

The cloud of dust was as wide and thick as the distant mountains and climbed to the sky.

First came a line of bearers, then teams of draft animals pulling sledges that floated a meter off the ground. Finally the centerpieces of the procession appeared out of the red clouds of dust: nine great floating platforms carrying tents and canopies and mounting green and blue flags, with pennants snapping smartly in the wind.

And hundreds of Tolians, large and small, young and old, all joined in the great parade, some pushing the great platforms along, others leading animals hitched to them in harness, and many riding in the luxurious shade.

Harry stood slackjawed as they passed.

He had been standing that way for a long time when an oddly shaped creature appeared in the midst of the caravan—tall, slender, with shrunken joints, a nearly bald head, and a ridiculously small mouth. It was a man.

"I'll bet you're Harry Simpson," he said. Harry blinked in surprise—partly because there had been no translating voice in his ear.

"Yes, I am," he stammered. "And you're—"

"Dr. Melville Grant, at your service," he said, taking a deep bow. "I believe we have a mutual friend—Victoria Dickinson. Did she tell you that I'd be expecting you?"

Harry laughed, snorting through dust-caked nostrils.

"She told me that someone would be expecting me," he said. "But she didn't tell me who."

Grant smiled. "I'm not surprised. I'm not accustomed to these games of secrecy."

"That's all right, neither am I."

That drew another smile. "I assume you haven't eaten. You wouldn't want to spoil the experience, now would you? Come along with me. Dinner will be ready in a couple of hours. We can take care of our business afterwards."

Harry nodded and fell into step alongside the exo-anthropologist. He still didn't have the slightest idea what was going on, but he wasn't about to let it show.

The great alien parade strode off across the desert, and this time he was a part of it.

When the sun was still a few degrees above the horizon, the Tolians slowed to a halt. Several of the largest, heaviest, and most overdressed members of the entourage came down off the floating platforms and assembled at the head of the parade. They talked, quietly at first, then with more vigor and volume, and finally with flamboyant gestures and abrupt movements, until they appeared to reach some kind of agreement, marching as a group to a point about forty meters to the north of the site of the discussion.

Once there, one member of the group planted a flag in the ground, while the rest grumbled and mumbled among themselves, then returned to their platforms. A moment later, the entire vast assemblage burst into frenzied activity as the Tolians made camp.

"They were deciding where to put the head table," said Dr. Melville Grant.

Harry turned to see the older man smiling at his confusion. Grant was at least sixty and his serene figure seemed to radiate dignity. Harry wondered if it had come with age or if he had always looked that way. Was it something one could learn, or did you have to have it in your genes?

"Do they do that a lot?"

"Every night. It makes sense if you understand the central organizing principal of the Tolian culture."

"And that is?"

Grant sighed, then it seemed as if a small switch had been flipped somewhere turning him into a live version of an on-line voice. "The Tolian civilization was very sophisticated before it fell apart. A sophisticated culture can develop quite a complex reaction to a traumatic event—especially an event on the scale of a planetary ecological collapse. I assume you saw the runners and scouts and advance parties."

"Yes. Are they like that with everyone or should I have taken it personally?"

He laughed. "Don't take it personally. They're all familiar with tourists and don't have much to do with them. And even though you and I can understand them through the local net," he said, tapping his ear, "they do not have the same capability. So they cannot understand what you or I say unless we use a hard terminal as a translator."

"I feel better then."

"Now, did you notice what the advance parties were doing?"

"Hunting and gathering from the look of it. Quite a fall from grace for a technological race."

"It would appear that way—but only on the surface. True, they were hunting and gathering. But the organizing social force behind the activity is much more sophisticated. The social hierarchy of each Tolian prolat is centered on the leaders of the contragrav platforms—a couple dozen all told."

"The Tolian chiefs?"

"Close, but not quite," Grant said. He laughed, inwardly, clearly at a private joke. "They are not chiefs, but chefs."

"Chefs?" Harry asked in disbelief.

"Master chefs. Each of them is the heir to the combined knowledge of their clans—recipes for sauces, appetizers, main courses, soups, desserts. The menus of each family are maintained and protected as the Tolians wander across their barren world."

"And the hunters and gatherers?"

"They are looking for the ingredients of each night's menu. The master chefs send them searching for the spices, vegetables, game, and fruit that they need to prepare their selected dishes. It's much more difficult and labor-intensive than simple hunting and gathering. Added to the challenge is the current state of the ecology. In order to support this number of Tolians, the tribes have to move more than forty kilometers a day."

"No wonder the runners ignored me," Harry said. "They were too busy to waste time gabbing with strangers."

"Exactly."

The feast was more than anything Harry could have imagined.

Within an hour, the tables were filled with food, though none of it was identifiable as more than soups, stews, breads, meat, vegetables, and sauces. Not that it mattered.

The range of tastes was like a symphony. The eating went on for hours and hours. Harry found it impossible to keep track of the competition among the chefs despite Grant's best efforts to provide a play-by-play commentary. In the end, however, there was no hiding the winner.

One of the minor chefs from a table at the far end of the assembly was rousted from his seat, paraded around in the center of the encampment, and awarded a pennant of black and gold, which he wrapped around his waist before returning to his place.

After that ceremony, the gathering slowly dissolved, with the chefs leading their parties back to their platforms and the torches sputtering out one by one.

Harry pulled himself to his feet with some difficulty and walked uncomfortably out into the desert. After a while, he looked up into the night. Here, away from the torches and the smoke from the camp fires, he could see the full blaze of stars that filled the sky.

This was not the meek sky of his home world, wrapped by dark clouds of dust that shielded the full glory of the Milky Way Galaxy. Naverly Tol was much closer to the hub of the Galaxy and high above its central plane. The galactic core was a soft yellow glow that filled a quarter of the celestial dome, while the dark dust clouds, pale glowing nebulae, and clusters of young blue stars that marked the spiral arms unwound to the north and south.

Harry found himself staring up into the astronomic depths until his neck burned and his eyes watered.

"Quite a view, isn't it?"

Grant's voice startled him out of his reverie and pulled him back to the surface of the planet.

"You have a talent for understatement," Harry said.

"I've been told that."

"Any idea how far we are from Boston?"

"That's a difficult question to answer," Grant said, kicking a rock across the gravelly desert floor. "It depends on your philosophy. Rik science says that distance is simply a mathematical illusion that can be overcome with some technological sleight of hand. The Tolians, on the other hand, have a view of time and space that is difficult to grasp. They never stay in one place long enough to acquire a sense of here and now. And yet their entire existence consists of repeating the same rituals of hunting, cooking, and dining over and over again. The combination of static time and constant motion makes for a unique view of the world."

"I can see that," Harry said, looking up in time to catch sight of a shooting star. "Judging from a strictly personal point of view, taking the transit here didn't involve travel at all."

"Exactly. When you study a variety of cultures, you come to realize that every way of looking at the world is artificial and in some fundamental way, wrong and incomplete."

"I guess I've felt that way more than once in my life," Harry said.

"One thing for certain, the transit technology will radically change how the human race thinks of time, space, and travel. And sooner than most people realize—if we are successful."

Harry felt a moment of disorientation. Dr. Grant had just stepped across the line from innocent discussion to conspiratorial plotting—and Harry realized abruptly that he was mostly unaware of the dimensions of the conspiracy and the plot. He kept his ignorance to himself and made an innocent, but leading reply.

"Yes, there is that," he said, hoping that he sounded like he knew what they were talking about.

In the starlight, Harry could see Grant slip a rik-sack from his shoulder, step closer, and hand it to him.

"Here it is," he said. "You realize how important this is, don't you?"

Harry froze. A moment's hesitation was all it took.

"Or do you?" Grant asked.

"To tell you the truth, Victoria didn't explain much to me."

"In that sack is a portable transit device. I assume she told you that you were to bring it back to Earth."

Harry felt a chill run up his spine. "Yes, that much was explained. I'm not sure I understand how it got here, though."

"It's a long story, and the less of it you know, the safer it is for all involved. It was brought here by others—not the Rik, of course. We were told of its existence and its importance. And those who told us recommended that we bring it home, examine it, and learn the secrets of that technology before the Rik end up controlling our world completely."

Harry whistled. No wonder Victoria hadn't explained any of this to him. There was much more going on here than he had even begun to suspect. He needed time to think.

Perhaps the time had come to call it quits with Victoria Dickinson. If that was possible. . . .

It had been a few years since he'd left the place, but MIT still had all the charm and beauty of a roof full of heating, ventilation, and air-conditioning equipment.

The buildings reminded him of something out of Eastern Europe's Communist days—acres of poured concrete growing out of neoclassical marble, towers of brick with walls of glass and Venetian blinds. The only advantage Harry could see in the utilitarian and artless architecture was the passion of its builders for connecting the buildings. It was possible to go from one end of campus to the other without ever stepping out into the cold.

He worked his way past the huge dewars of liquid nitrogen that cluttered the halls of the physics department. The bulletin boards that lined the walls were filled with the dry business of technical and engineering life—except for the Peace, Justice, Freedom, and Liberation board, which was covered with strident messages urging students to join a variety of organizations aimed at throwing off the yoke of a variety of villains, beginning with the school administration, running through several banks and corporations, and ending at the top with the Riks.

Harry felt a certain sympathy for those groups as he tightened the strap on the rik-sack that carried his contraband.

He wasn't quite sure when he made the decision to withhold his cargo from Victoria Dickinson. It was some time before he had returned to the Rik transit station in Riverside, at the far end of the Green Line.

One of the weightier factors in his decision was the sudden recollection that Victoria's father wasn't just any old son-of-a-bitch with too much money. He was the old son-of-a-bitch who owned Mass-Rik Imports, the company that operated the network and controlled all the think-mans in the city.

At least part of the puzzle fell into place when he put that piece on the table. And that made Harry a little more nervous. He knew that in the end, it would be easy to turn his back on Victoria and walk away. But he was not as sure that it would be the same with her father.

He found Arleigh Dean alone in the room on the fourth floor where the Students for the Exploration and Exploitation of Space were scheduled to meet. His red hair nearly matched the plaid flannel shirt he wore. A pencil rested on one ear, threaded through the top of a beard shot through with gray hairs—the only sign of change in the years since he'd been Harry's roommate.

"Say Harry, long time no see," he said as the two men greeted each other. "What brings you down here from Harvard Yard?"

"Big business," Harry said. "Big, black magic business. I'll tell you all about it if you'll tell me what happened to the kids who were supposed to meet here today."

Arleigh laughed, but Harry could feel the pain. "They're not interested in space anymore," he said. "Not when you can get there with a short ride on the T."

"I guess you're right. But I've got something that could change all that. Right here in my bag." Harry pulled his rik-sack off his shoulder and withdrew the contents—a single piece of clearly extraterrestrial technology, all smooth-flowing surfaces, purple-pigmented parts, and a set of universal jacks for Rik-technology attachments.

Arleigh let out a long, low whistle. "Looks neat. What is it?"

Harry sat down and told him the story of his trip to Naverly Tol. When he was done, Arleigh sat down too.

"How did you get that thing past customs? The Alien Technology Bureau is picky about what it wants in the hands of the public."

"I didn't think I would at first," Harry said. "I was in the inspection line at the transit station, waiting for them to check my rik-sack. But when I got to the head of the line, the woman behind me dropped a bagful of about twenty creatures that looked like rabbits with wings. They went all over the place, and the inspectors went running after them. They just waved the rest of us through. I figured Victoria had set it up, and decided I wanted more time to think before I just handed it over to her. So instead of grabbing the T, I hiked on down the street and grabbed a cab."

"How do you know this thing is for real?"

"I don't," Harry said. "That's why I came to you."

"Geez, Harry, I don't know anything about this stuff. I'm too busy teaching kids how to push electrons through cloud chambers." He lifted the device, gauging its heft. He squinted for a moment, then his eyes sparkled. "But I do know where we can go for an expert opinion. Come with me."

Arleigh lead Harry on a twisted path through several buildings, through narrow white-walled corridors, past windows offering glimpses of cramped industrial courtyards, and office after identical office. They ended up in a small dusty cul-de-sac where the placard on the door read: "Department of Alien Technology." Arleigh pushed through the doors into a bare workroom where two young undergrads in white lab coats were playing computer games on their virtual terminals.

"Gotcha!" one yelled. "I knew you couldn't hide behind that rubble all day."

The other jumped to his feet in sudden embarrassment at the sight of the two visitors. Harry felt ashamed, but for a different reason. The bare, unused lab revealed the painful truth that thanks to the Riks and the government there was precious little alien technology available for humans to study.

But that was about to change.

"Boys, call your boss," Arleigh said. "I've got a project for you."

The walk up from Kenmore Square and over the Turnpike was brutal. Harry shifted the bag of groceries to one arm and pulled up the clear faceplate of his rik-suit. Now he looked like a beached scuba diver.

As he headed towards Fenway Park, the wind blew fine crystals of powdered snow off the top of the stadium, which stuck to his faceplate and turned to water. A few minutes later, he walked through the ice-encrusted parking lot and into the Howard Johnson's motel where he'd been holed up for two days.

There was a message for him on the phone when he got to his room. It had to be Arleigh—or else terribly bad news. He'd told no one else where he was and had sworn Arleigh to secrecy.

He stripped out of his rik-suit and retrieved a package of cookies from his grocery bag. Since checking into the motel, he'd gotten his first decent sleep in two days. When he was through wolfing down half a bag of Fig Newtons, a radical departure from Tolian fare but suitable for his purposes, he called Arleigh back.

The news was good.

"We still haven't got the slightest idea why it works, but we have been able to link up with the controls," the MIT professor said. "The Rik's universal input jack is something the boys up in the workshop know their way around. They've run the tutorial and the diagnostic, and now they're ready to do some field tests. And we all thought you might want to be in on that phase of the program."

Harry felt a rush of excitement and fear. "I never thought about it before," he said. "I just wanted to find out if the thing is for real."

"Then field tests are the only way to do that. Are you game?"

"What do I have to do?"

"Take a little trip."

The fear and excitement welled up and spilled over. "How little?"

"Just a matter of meters. Nothing interstellar. What do you think?"

"Isn't it dangerous?"

"Not according to the lab boys," Arleigh said. "They say this is a standard piece of merchandise on most Rik worlds. Sort of the equivalent of an HM Lektrosport. It's designed so we can't do anything terribly stupid, like pop out in the middle of a wall somewhere."

"If we do, can we sue the Riks?"

"From what you told me, we'd have a hard time finding the dealer who sold it to us."

"I guess so," Harry admitted. "Come on over, then. You know where I am."

Arleigh was there in less than half an hour. He smiled when he stepped through the door and pulled the transit device out of the rik-sack. It took them a couple of minutes to prepare. They dressed for the cold—Arleigh in a quilted down vest, Harry in his rik-suit.

"We're going to take just a little jump," Arleigh said. "One hundred meters to the north exactly. Just across the street from here."

Harry looked through string bead curtains at the high green walls of Fenway Park—less than a hundred meters away to the north.

"Sounds good to me. Play ball."

Arleigh smiled, an expression made ominously wolfish by his red beard. "Stand by—on zero—four . . . three . . . two . . . one. . . ." They both sucked in their breaths and jammed their eyes shut involuntarily. There was a moment of darkness, deeper than night and briefer than a thought—

—And then they were falling!

The drop was brief, but the rush of adrenaline started Harry's heart pounding like a triphammer. Arleigh let out a yell just before they hit the ground. In better weather it might have been a softer landing, but the winter chill had left the grassy outfield as hard as concrete.

Harry felt as if he'd broken his kneecap, but the pain faded quickly. Arleigh looked stunned.

"Damn! I forgot—the field in Fenway is sunk below street level!" he cried.

"Next time warn me before we do something like that," Harry said, rubbing his knee.

"It's just as well," Arleigh said. "We might just as easily have wound up knee-deep in a snow bank."

He looked around. A bright blue sky formed a canopy overhead. The scoreboard was dark and silent, the bleachers empty, and the seats dusted with snow. And the Big Green Wall loomed over them in left field.

"Well, I guess we're lucky then," Harry said. "Now what?"

"Now we run like hell," Arleigh said. "Here come the guard dogs."

Three large, dark shapes came racing across the infield from the dugout in great distance-swallowing bounds.

Arleigh grabbed the transit device, and Harry looked around for the best direction to escape. "We're never going to make it," he said.

The three animals drew swiftly closer. Arleigh swore under his breath. Harry could see that he was on-line, involved with menus and mice. He knew as well as Arleigh did that they didn't have a prayer of calculating the proper distance and elevation to get onto the street, let alone back to the motel. All he could do was stand by helplessly until they were cornered.

"I just hope these dogs are trained to hold off instead of attack," Harry said.

In less than a minute, the animals were upon them. It was then that astonishment overtook fear.

"Arleigh, I may be imagining this, but I don't think those are dogs."

The MIT professor broke from his internal contemplation of the MRI on-line network long enough to focus on the three creatures that were now spreading out to surround them. "I think you're right," he said.

The animals were too bulky, their legs too muscular, and their heads too big for dogs. Besides that, they were wearing black vests with radios attached.

"Stop where you are!" commanded the leader of the small pack. "You are trespassing. The police have been called. You will wait until they arrive to be arrested."

"Who's to be arrested?" Harry asked. "Us or the police?"

The lead animal shook its head in puzzlement. "I do not understand the question."

"Syntactical ambiguity," Harry said. "You told us to wait until the police arrive to be arrested. That can be interpreted to mean that the police will arrive to be arrested, and we're to wait until they do."

"Dirty-bad language," the leader said. "Too many dirty-bad meanings."

"You're not guard dogs," Harry said. "You're offworlders. What are you doing here?"

"We are under contract through Mass-Rik Imports to guard these premises. We come from Howl-Moon-Rock on special employment visas. Sorry we put your dogs out of a job, but we have to eat, too."

"Alien labor contractees," Arleigh said. "I don't believe it."

Harry chuckled. "I guess it's better than a bunch of Dobermans ready to rip our throats out."

"Yeah. I'll bet you couldn't get a good grammar discussion going with a Doberman without a pocket full of liver snacks."

"What are you guys doing this far from home?" Harry asked, ignoring Arleigh's remark. "No jobs back on Howl-Moon-Rock?"

"Our world economy broke down several lifetimes ago," the lead guard said. "We now provide contract services for the Rik, and they provide our race with its basic needs."

"Several lifetimes ago? That wouldn't be about the time the Rik came upon you, would it?" Arleigh asked.

Before the alien could answer, Harry asked: "How much do you make on this job?"

"Make? Dirty-bad ambiguity again."

"Earn. Profit. Surplus product. How much?"

"No earning. No profit. No surplus product. I repeat: We provide contract services for the Rik, and they provide our race with its basic needs."

"Slave alien labor contractees," Arleigh said.

"Slave alien labor contractees who talk too much," Harry noted. "I'll bet the Rik wouldn't like it if they knew what they've told us about them."

"I wish we could repay the favor."

"Me, too. But I'm afraid we don't have time right now to explain to them the theory of labor value."

"It would be more in our interest to find a higher place to wait for the police," Arleigh said. "If-ay oo-yay oh-knay at-whay I ean-may."

Harry smiled and nodded in agreement. "Say fellow, do you think we could get out of the wind. Center field in February is no place to wait for Boston's finest."

"Boston's finest?" the pack leader asked.

"Police. It's a figure of speech. Another dirty-bad ambiguity. Really, though, couldn't we wait in an office upstairs? Or at least up out of the wind."

The alien paused for a moment, tilting its head from side to side. It sniffed the air, then declared: "Follow me. And do not try anything tricky. We are authorized to use violent force if you attempt to escape."

"Nothing could be further from our minds," Harry said as they marched towards home plate in single file, the leader first, humans next, and the other two guards in the rear. "By the way, you're not telepathic or anything, are you?"

"If we were, we wouldn't need dirty-bad language to communicate, would we?" it replied.

They passed through a gate behind home plate and through two sets of swinging double doors into a corridor lined with frosted glass. Harry's heart sagged as he realized that they were still at the level of the ballfield, then soared when they turned into a flight of wide stairs halfway down the hall. They went up two flights, then into a low-ceilinged lobby area where the guards took up positions at either end and the leader stationed itself in front of the main doorway.

"The police will be here in a minute or two," it said. "Do not attempt to resist arrest."

"No problem," Harry said. "Arleigh, how are we doing?"

"No problem," Arleigh said. "Give me five seconds. Four . . . three . . . two . . . one. . . ."

Harry grabbed Arleigh's hand as he finished the count. "One . . . zero!"

The world turned black, then reassembled itself as the sidewalk north of Fenway Park. Harry recognized the bar on the corner and offices across the street. A short distance away, a police patrol car was coming to a stop in front of the main entrance to the stadium.

"This way," Harry said, tugging on Arleigh's arm. He hurried across the street and down an alleyway. They emerged in front of a parking lot, between two cars parked haphazardly amidst the piles of blackened snow.

"We should get back to the motel," Arleigh said. "My laptop's still in your room."

Harry looked around cautiously, then beckoned his friend to follow him. A few minutes later, they had materialized back in the room at the Howard Johnson's.

They barely had time to catch their breath and stash the transit device in the rik-sack when there was a knock on the door, and Harry's heart leaped into his throat once again.

He switched on the television and dialed up the hall monitor. The image on the screen showed three men who could easily have been on loan from the New England Patriots offensive line standing outside his room.

He and Arleigh scrambled and nearly bumped heads trying to pull the transit device out of the sack. Arleigh was first to succeed, and he went on-line while Harry tiptoed to the door and slipped the bolt, chain, and safety latch into place. The last of those snapped shut with a loud click that sounded like a gun going off.

The knocking was replaced with pounding. Then, after a pause, came a tremendous crash. Harry saw on the TV that the heavyweights were throwing themselves at the door.

He ran back to Arleigh, who was now finished with his work. He looked up in time to see the door frame turn to splinters where the bolt, chain, and safety latch had been anchored. The door itself flew open and the three men came tumbling over each other into the cramped room.

Then the world turned black one more time as they fled the motel. . . .

The store above Harvard Square was stuffed with rows of shelves and the shelves with rows of hardcover books, paperbacks, CD-ROMs, and old magazines, filling the air with a musty smell of age that reminded Harry of his grandmother's basement.

A few posters hung from the walls, their edges tattered and their corners cracked. The man behind the counter had a face that still looked young, but his hair had started to turn gray around the edges.

The bookshop sat on the second floor, and from the window in the front Harry could easily see most of the square.

He pretended to be studying the books, but he was really studying the street. He'd been here for more than half an hour now, watching for the three thugs who'd chased him out of the motel—or others like them.

After a long time of seeing nothing unusual down below, he spotted Victoria Dickinson walking across the street. He scanned the square quickly, trying to find the musclebound crew in the crowd. They wouldn't be hard to pick out—if they were there.

But he couldn't find them, and Victoria disappeared into the restaurant downstairs from the bookstore. She was right on time.

Harry knew that sooner or later he would have to talk to Victoria—or to her father. He couldn't run forever. The motel room was quickly draining his cash reserves. And he wasn't going to be left alone.

It was just that he was reluctant to turn over the transit device to a power-hungry greed-monster like Victoria's father.

And the more the gap between him and Victoria grew, the more he realized just how hungry she and her father could be.

So he'd resorted to old-fashioned means, leaving a message on Victoria's voice-mail, telling her where and when they could meet.

He waited for another ten minutes to see if the dropouts from the Patriots offensive line were going to show up fashionably late, then he went downstairs to meet her.

The restaurant was a German place, all dark wooden paneling with photographs on the walls of Jack Dempsey, some unidentified cardinal, and dozens of anonymous dinner parties. A plastic grape arbor ran along the shelf over the bar beneath rows of large mugs with faces on them.

Once upon a time, it had been a popular place with Cambridge students. But that was when Germany was still a strange and exotic land. The definition of exotic had changed significantly since then, and as a result the place was nearly empty.

Harry went through the archway on the left and into a private bar where Victoria waited for him. She was wearing a black coat with fur trim, high white boots, and her nastiest sneer.

"Don't start with me, Victoria," Harry said before she could open her mouth. "First of all, we're through, you and me. Take that as given. I don't like being used. And I don't like being chased or threatened."

"Darling, using people is what it's all about," she replied, turning the sneer into a smile that under other circumstances—and from a different woman—might have been endearing. "Did you expect anything else? I used you, you used me. Quid pro quo."

Harry refused to be angered by her easy-handed treatment of him.

"Except that there was never any quid for this quo," he said. "Just those three dinosaurs coming after me at the hotel."

"Whatever are you talking about?" Victoria asked. "Who's been threatening you? All I ever asked was a favor from you—one you were perfectly willing to do for me a few days ago."

"Are you saying you don't know anything about the thugs who came after me today?"

"Thugs? I don't know any thugs. Although it would serve you right if they did come after you. You have something of mine, and I don't think much of your holding onto it."

"Something of yours? That's a matter of opinion."

"And in your opinion—"

"In my opinion, it's stolen property. Salvage goods. Whoever has it is the rightful owner by possession."

Victoria frowned. She turned away from him, looked down into her coffee.

"So where is it?" she asked, breaking the long silence between them.

"Somewhere safe."

"That's just like you. Do you have any idea what you're going to do with it?"

"I don't know," Harry said. "I haven't decided yet. I don't even know what my choices are."

"Then let me tell you what they are. You don't realize what you're up against. This is bigger than you or me. This is bigger even than my father. He's just another player in this game, but he's a big one. He enjoys being double-crossed even less than I do. And he doesn't like you as much as I do."

Which was a mixed blessing, Harry noted silently. "And that means?"

"That means that sooner or later, his men will catch up with you. They'll make you tell them where you put the package. While they're at it, they'll make you tell them a lot of things you never even dreamed you knew. I'm not just saying this to scare you, Harry—though it wouldn't hurt you to be a little scared. I really don't want to see anything bad happen to you. Not anything truly bad."

"I'll keep that in mind."

"It's not too late, Harry. I'll still take you back, you know. It can be just the same as it was before all this."

Harry smiled and shook his head softly. He didn't think she might be sincere—not even for an instant. He knew what Victoria was and what she represented—she and her father.

People had come up with a number of ways to deal with the changes that the Rik had brought to the world in the last few years. One approach was to adapt to each change in turn, preserving as much as was necessary of the old before incorporating the new. The other was to grab whatever advantage you could and exploit it for all it was worth while there was still time left.

Harry had already decided against the selfish, grasping approach. He just wasn't sure how he was going to handle the alternative.

"We both know it can never be the same as it was," he said. And with that, he turned his back on Victoria and headed for the front door. Then he thought twice.

He walked instead through the main dining room, into a smaller banquet room, then into the kitchen. He ducked out the back of the restaurant into a narrow snow-packed alley, which led down the block to the parking garage and Dunster Street.

This conspiracy game could be fun, he thought as he maneuvered around overflowing trash cans. Fun until one considered the hazards. And being a conspiracy of one had its own drawbacks.

Finally, once he was sure he wasn't being followed, he doubled back and headed towards Harvard.

Harry slipped through the back door of the Harvard Science Center and slip-stepped down the stairs under the big fire door that hung over the basement entryway like the sword of Damocles. He headed straight for the Museum of Scientific Artifacts.

It was a small room, but behind the glass stood large displays that included a six-foot-long brass telescope, Galileo's military compass and quadrant, ivory orreries, and row upon row of brass and varnished wood devices whose purposes he could only guess.

The museum was closed now, but he'd had a part-time job here last semester and knew the master code for the door lock.

In a locked chamber behind Galileo's instruments sat a lacquered wooden case with brass fittings that he'd selected himself. No one would ever have known that the box labeled "1891 Voltage Phase Rectifier" actually contained the alien machine.

It was still there. At the last minute, it had occurred to Harry that it might be possible for someone to activate the thing from a distance and spirit it away from its hiding place, but his momentary fear was unfounded.

Earlier in the day, he'd talked to Arleigh, who told him that the boys in the MIT lab had learned much more about the device's control program.

Now it was ready to use as its makers had intended—tied into the think-man network. Harry could go anywhere he wanted to at the push of a button.

He turned on his think-man and logged back on-line. It had been only a couple of days since he'd felt the virtual mouse in his hand, seen the sparkle of the menu in his eye, and heard the voice in his ear, but it seemed like years.

Professor Epstein was right, he realized. With this device plugged into his head, he had given up thinking for himself. Otherwise, he knew, he would have questioned Victoria's request more deeply. He might never have gone to Naverly Tol if he'd been thinking more clearly. He might never have taken up with Victoria in the first place.

He rolled the mouse up, clicked it, and came up with a menu custom-designed for the transit device. He dialed up Quincy Market, and double-clicked the mouse.

When the darkness faded back to light, he stood in the cobblestoned courtyard between the Market and Faneuil Hall. An inch of ice caked the ground, with narrow paths cut through it for pedestrians. The exposed stones were still slippery, though, and Harry almost lost his balance more than once as he crossed the yard to the building.

The smell of hot cooking oil, fried meats, and fresh-baked bread and pastries filled the air, and hundreds of hungry Bostonians filled the space between the rows of restaurants, delis, bakeries, raw bars, and rotisseries.

It occurred to Harry as he worked his way through the mass of diners that if everyone had one of the transit devices, Quincy Market would be impossible to negotiate. It was hard enough as it was, with everyone trying to make up their minds what to eat. But only so many people could be here at once. All that would change with the Rik device.

When things changed, all of Boston would become one vast Quincy Market.

Everyone would be everywhere all the time. It would all be as crowded as this madhouse.

Harry bought himself a skewer of scallops wrapped in bacon and a fresh-baked walnut brownie, then worked his way back outside. He didn't dare linger here for long, not while he was still on-line. Victoria and her dad would be after him before he could finish eating.

So a moment later, he was in Kenmore Square, under the big Citgo Electric sign. The traffic roared past in both directions, and pedestrians clustered on the corner waiting to make their break for the far side of Commonwealth Avenue. With the transit device all that would be gone, he realized wistfully, nostalgic for a past that had not yet departed the present.

"Why did the chicken cross the road?" he asked himself. "Because its transit device was on the other side."

He ate his supper. The scallops were rich, but the bacon was undercooked. He needed something to wash it down, so he stepped into a convenience store and pulled a single bottle of Sam Adams out of the cooler.

Then in a moment of devilishness, he leaped straight across the Charles River to the park along Memorial Drive in front of MIT.

That would be something society would have to work hard to cope with, he told himself as he twisted the top off the beer bottle. He had never stolen anything in his life, but with the transit device the temptation was irresistible. It was just too easy.

He drank some beer and looked across the Charles at the city—the high shafts of the Prudential and the Hancock buildings, the jumbled pile of brownstone houses on Beacon Hill, the long span of Harvard Bridge across the river.

The Sun was down, but it still painted the sky pale yellow to the west. The lights were on all over the city, giving the buildings a transparent, insubstantial look. Boston seemed to shimmer in the cold winter air like a mirage. It was an illusion, a momentary confluence of time and space and matter that would all be swept away once humanity had the power to be anywhere it wanted in the blink of an eye.

The pile of old brownstones on Beacon Hill contrasted with the steel and glass towers of Back Bay. How little time had passed between the building of one and the other. Humanity was moving so quickly up the line of progress. But thanks to the Rik, they were about to experience an unprecedented acceleration.

Are we really ready for that? he asked himself.

For a moment, he felt small and immaterial, like he did under the rich Tolian sky. Only now he felt the entire human race joining him in its tiny insignificance. There was so much to know and so little time to know it.

For a moment, he was seized with the impulse to hurl the transit device into the Charles River and settle the question for good. Except that it wouldn't be settled—that much he knew.

Thinking for yourself was difficult, Harry decided at long last. Of course it was easier to dial up the right menu and listen to a soothing voice in your ear. But where was the menu for Difficult Moral Choices?

There was none, of course, but Harry realized suddenly that he knew a good alternative. And it wasn't online.

He jumped again, across Cambridge to a Harvard office. A moment later, he made a final jump, then logged off, turned off his think-man, and began jogging down the street towards his destination, hoping that Victoria's father wouldn't be able to track him down.

When Professor Epstein answered the door, Harry allowed himself a momentary sigh of relief. He'd worried that she wouldn't be home. She had a puzzled look on her face, but she invited him into the kitchen and offered him a cup of coffee.

The place was filled with a confused mixture of decorating styles. The kitchen was outfitted with an enameled table and matching appliances that looked nearly a century old—much like the house itself. The hallway was done in a Southwestern motif with woven Navajo blankets on the wall and a cactus garden beneath the window. What he saw of the living room contained personal relics—photos, posters, books, awards. It was as if the professor had collected layers of design throughout her long life and gathered them together in this small frame house on a Cambridge side street.

"My door is always open to students, Mr. Simpson," she said. "But I'm not sure why you're here. My usual office hours are posted."

"It's something of an emergency, Professor," Harry said as he set his rik-sack down in the chair and warmed his hands around the hot coffee. "It's a long story, though, so you'll have to bear with me."

Her expression changed from bewilderment to astonishment to indignation as Harry spun his tale.

"So what do I do now?" he asked.

"I don't know how to answer that question, Harry, but I know someone who might. Excuse me." She went down the hall and picked up the phone. Harry could hear her talk briefly, then hang up.

"Have another cup of coffee," Professor Epstein said. "She'll be here in a couple of minutes. She lives right around the corner."

Just as Harry drained his cup, the kitchen door opened, and in walked Elsie Hays, the extraterrestrial trade representative.

"We weren't prepared for the 21st century as it was, never mind the Rik," Elsie said. "Our political leaders know next to nothing about technology and science. Our institutions are not equipped to deal with the consequences of rapid technological change—worldwide problems like pollution, resource depletion, transportation, economic and social dislocation, and a host of things."

Harry tried to listen politely, but he couldn't help but fidget in his seat. Why was it that everyone over forty felt they had to give you a half-hour lecture before answering your questions?

"When the Rik arrived with all their advanced technology, everyone thought it was the millennium," Elsie said. "They thought we would just start using all those wonderful machines, life would become effortless, and all our problems would be solved."

"That's what they thought for about a month," Harry said.

"Actually it lasted about a year. But then we started to learn about other intelligent species on other planets. And we discovered that contact with the Rik is not a universally beneficial experience."

"So I've come to understand," Harry said.

"Some worlds have had their cultures completely disrupted, leaving them dependent on the Rik for everything."

Harry thought of the guard dog substitutes at Fenway Park. Alien slave contract laborers.

"Other worlds have had their indigenous technology so disturbed that it destroyed the ecological balance."

"Like Naverly Tol," Harry said, remembering the wind-swept deserts and the shattered civilization of the master chefs.

"Like Naverly Tol," Elsie said.

"Which is why you don't think I should let Victoria's father have the transit device," Harry said.

"Exactly," Elsie said. "Not today, at least. Some day we will be ready for the dislocations that the device will produce. But if released now, it would destroy the world economy overnight. And who knows what would happen to humanity after that? We must pick and choose carefully among the mysteries and treasures the Rik have brought us. If we choose wrong, there is no going back and doing it over again."

"I can imagine."

"So what are you going to do now?"

"I've been trying to figure that one out for the past couple of hours," Harry said.

"Then let me help," Elsie said. "It's not going to be easy to turn your back on Miss Dickinson and her father. They're still going to want their toy. And if you won't give it to them, they're going to go back and start over again. Unless. . . ."

"Unless what?"

"Unless you can find a way to discourage them."

Elsie Hays was on the phone to the Alien Technology Bureau when the pounding started on the front door.

They'd been burning up the wires for nearly an hour now. First Elsie had called the Bureau, then Harry had called Arleigh, then everyone had gotten together on one line—with Harry on the extension upstairs.

Then the doorbell rang, and before Professor Epstein could answer it, the windows began to rattle and the floor started to shake from the impatient hammering.

The pit of Harry's stomach sank towards the floor as he realized too late what must have happened. Victoria's father had traced him. It wouldn't have taken much. They must have tracked his last transit hop to Professor Epstein's Harvard office, and then found her home address from there. Once he thought about it, Harry was surprised they hadn't arrived sooner.

"They're here," he said breathlessly.

Professor Epstein was at the window, looking out onto the front porch. "There's two of them," she said. "Big guys. Head for the back door."

But now Elsie came running up the hallway from the kitchen, waving them back. "There's another one in the backyard. You can't go out there."

Harry grabbed the phone from the table where Elsie had left it and punched Arleigh's number. It took him an eternity to answer the phone, and when he did Harry talked fast. "Arleigh, I don't have much time, so listen up. They're about to smash down the door. You know what to do, and this is the time to do it."

By the time he was finished, the pounding on the door had become frighteningly violent. Any second now Harry expected to hear the crash of breaking glass.

He pushed past Professor Epstein and dashed for the kitchen, sliding across the floor to a stop. He grabbed his rik-sack and switched on his thinkman.

"Don't worry. I have a better way to get out of here. Would you like to come along?"

"And leave my house to these barbarians? Not on your life," she said as she followed him into the room. She opened a cupboard beside the stove and pulled out a cast iron frying pan, waving it ominously in the air. "Come here, Elsie, I've got one of these for you, too."

"Then I guess I'll see you in class," Harry said as he squeezed the virtual mouse tightly. The room faded into darkness. . . .

. . . And re-formed itself, not as the broad plaza at Copley Square, but as a spacious, low-ceilinged office with a long window on one side looking out over the city.

Harry swallowed hard. This wasn't where he'd planned to go.

He wasn't alone. The off-duty football team stood in an uneasy circle around him, a long table surrounded with heavy wooden chairs behind them.

He turned around to see another man, older and wearing a suit that probably cost a semester's tuition at Harvard, seated behind a desk the size of a limousine.

"Hello, darling. We've been waiting for you to drop in."

Harry turned again to see Victoria Dickinson, sitting on a leather-covered couch, her legs drawn up beneath her. She stood slowly, then walked over to take Harry by the hand and lead him to the big desk.

"Daddy, I don't think you've met Harry. Harry, this is my father—Albert Dickinson. He's been trying to get hold of you all day."

Albert Dickinson stood up, but didn't bother to offer Harry his hand. He was an intense man—his eyes burned brightly, his face was knotted up with tension, and his hair was cut severely above the ears but left shaggy on top.

"Simpson, you're a royal pain in the ass, do you know that?"

Harry breathed cautiously. It occurred to him that he might have it within himself to resist whatever pressure the elder Dickinson was going to bring to bear on him. He managed to do that with Victoria, why not her father?

"I don't mean to be," he said. Dickinson motioned to his men, who moved quickly up beside him. They grabbed him by the arms. A flood of adrenaline pumped through him. He prepared himself for violence—remembering a fistfight he'd been in at an ecology camp in Montana years ago. If this was going to be anything like that, it would be sharp and brief.

But there was no violence. They simply relieved him of his rik-sack and deposited it on the desk in front of Dickinson.

"So this is it?" he asked. "You put me through a lot of trouble over this. It would have been a lot easier if you'd just brought it straight to us like you were told to."

"I don't always do what I'm told to do," Harry said. "I'm funny that way." He wasn't sure what he was doing, baiting the powerful man behind the desk, but he had to play for time. The plan had not called for him to be in the place for several hours yet.

"I guess not," he said. "I'm funny that way, too. But that doesn't mean I'll put up with it from someone else."

"Oh Daddy, he wasn't doing it to be personal," Victoria said, cooing and fawning. But Dickinson glared at her and she turned stiff and cold, pouting at her father silently.

"I guess they told you all about me," Dickinson said. Since no one had told Harry all about him—not even Victoria—Harry was surprised by the comment, but he kept the surprise hidden. "You can believe most of it, too. I'm as bad as they say I am. I always have been, I guess. At least that's what I've been told all my life."

Victoria's father pushed his chair back and walked over to a cabinet in the corner. He pulled out a square bottle of dark liquid and poured himself a drink.

"But good or bad, the one thing they can't deny is that I'm a success," he said. "Look at this office. Look at how high up we are. It's a long way up from the street. I built this building and the business inside it. Whether they like it or not, it's mine. And so is this toy you've been playing with."

He returned to the desk and slid the transit device out of the rik-sack. He stroked the violet casing and poked at the electronic jacks. "You really gave it a workout today, didn't you? Quincy Market, Kenmore Square, the Charles, MIT, Harvard."

Harry felt a sudden surge of fear. How did he know? He realized a second later that he must have given himself away.

"You're wondering how I know that," Dickinson said. "Who do you think makes the think-man, Simpson? I own the mainframe that you plug into every time you go on-line. I am MRI. We can record everything you do with the system. And we can break in and block or change the commands you enter to activate the machine. That's how we brought you here."

Harry sighed. The momentary sense of powerlessness passed. It bothered him that Dickinson knew his every move, but that knowledge was worth little now.

And he was sure that Dickinson didn't know what else he'd been up to—or what the others were up to now that he had failed to check in from Copley Square. And that was all the more reason to keep him talking—to give them the time they needed.

"What do you think—will it make the customers happy?" Dickinson asked abruptly.

Harry was taken aback by the question, but answered it haltingly. "It works well enough," he said. "No dizziness or vertigo. It's a lot quieter than the T."

Dickinson let a smile crack through his grim face. "The T is going to be a museum when we're through," he said.

"That's the only problem I can see with it," Harry said. "I like the T."

"Forget it, Simpson. That world is gone already. It died the day the Riks landed at the Grand Canyon. The only question is who is going to die with it. I don't intend to be one who does."

"I'd rather not be one either," Harry said.

"Then you'd better decide which team you're on. Those cowards in the government are only going to make things worse. The longer they delay letting in Rik technology, the weaker we will be. And the Rik don't like weakness. They'll take over in a minute if they think they can get away with it."

Harry wondered why they would bother if they could get people like Dickinson to do it for them. He did not voice the thought aloud.

"Believe me, Simpson, we've only got one chance, and that is to get our hands on as much of the stuff as the Rik will give us. Don't let those government bureaucrats tell you any different."

"As a matter of fact," Harry said, "that's exactly what they were telling me when your goons showed up."

"That's what I figured. Did you swallow any of it?"

"I prefer to think for myself," Harry said.

"That doesn't answer my question," Dickinson said.

Harry was about to speak when someone yelled from behind him.

"Hey! Look at that!"

Everyone looked at once as the transit device on the desk gave off an iridescent purple light.

It disappeared from sight, then reappeared a few inches to the right. Harry felt his heart sink. That wasn't what he expected to happen.

Then it vanished, leaving only a brief draft as the air rushed in to fill the space where it had been.

"Goddamn it!" Dickinson roared, as he reached for the empty space on his desk. He looked up at Harry with hate-filled eyes. "What did you do with it, Simpson?"

Harry mustered all his will to hold back the smile that was struggling to the surface. Arleigh had done his job. The moment of fear when Harry went to retrieve the device from the basement of the Science Center had been the inspiration for the disappearing trick. But to hide his complicity, Harry shrugged his shoulders, opened his eyes wide, and let his jaw drop.

"Never mind. You won't get away with it." He grabbed the phone and punched the buttons angrily. "Hello? Were you monitoring Simpson's link? What about the control menus for the transit machine? Then tell me what just happened."

There was a long pause as the unfortunate technician at the other end of the line replied, then Dickinson turned visibly red. "What do you mean you don't know? Are you all sleeping down there?"

There was another silence, then: "All right, go through the traces. Figure out what happened and call me back the minute you know what happened."

He turned back to Harry.

"I don't know your game, Simpson, but whatever you've cooked up, I'm going to get that machine back. Nothing you can do will stop me."

Harry shook his head and looked at Victoria. She glared at him, then looked at her father. "I'm not going to forget that you told me we could trust this bastard," Dickinson told her.

The look of desperate fear that seized her face made Harry's heart ache. He realized now why he had been drawn to Victoria in the first place. Deep behind that mask of dominance and will was a tortured victim. But it was too late to do anything for her now. It had been too late all along.

"All right," Dickinson said, motioning to his henchmen. "Take him next door and find out what they did with the machine."

Harry felt his knees weaken as one of the goons grabbed his left arm and another took the right. For a moment, he felt much like what Victoria must be feeling—weak and powerless. He hoped that Arleigh completed his tasks quickly.

They were halfway to the door when he did.

All three of them turned their heads at the sound of Victoria's gasp and Dickinson's voice, choked off in mid-oath.

Suddenly, in the center of the office stood a squad of armed men, a woman in a business suit, and Arleigh Dean clutching Harry's battered rik-sack.

The woman held a thick sheaf of legal documents in one hand. "Albert Dickinson, I am U.S. Attorney Deborah Wilkes and I have a warrant for your arrest for violations of the Alien Trade Act—with arrangements already being made to add charges of kidnapping and unlawful restraint. These men are U.S. Marshals and are here to take you into custody. I would suggest that you do not resist."

The marshals spread out quickly. Three of them rushed the goons that held Harry and took them into custody.

"You have the right to remain silent," the U.S. attorney said. As she continued the litany, Victoria gave Harry a look of pure hate.

At last the smile he'd been holding back broke loose and filled his face.

Arleigh came over to his side. "You don't know how difficult it was to do that work in only a couple of minutes," he said. "And then I had to move the thing a couple of centimeters to find out where it was—where you were. Then I had to go over and pick up the marshals, only they weren't ready yet."

No one seemed to be paying much attention to them at the moment. The marshals were putting the cuffs on the goons.

"Never mind that now," Harry said. "Just get us out of here."

Arleigh's eyes widened, then he shook his head. A moment later the room turned dark—just as Harry heard the U.S. attorney shout: "Stop!"

Then the room reassembled itself as the broad plaza in front of the Christian Science cathedral, complete with a bone-chilling wind scraping across Harry's face and the Prudential building towering overhead.

Harry met with Elsie Hays a few days later in the regional office of the Bureau of Alien Technology.

"Wilkes still wants to charge you with tampering with evidence, obstruction of justice, and smuggling," Hays said.

"If it weren't for me, she never would have been able to bring charges against anybody," Harry said, feeling bold in the face of uncertainty.

"That's what we told her," Elsie said. "We explained how you provided the means to activate the transit device while it was sitting in Dickinson's office."

"Am I going to need a lawyer?"

"No, I don't think so. She's going to be busy enough taking care of Dickinson. He's the one who's going to need the lawyer—and for quite some time to come. Besides, we need your testimony to make the case against him, so you're getting immunity."

"And MRI?" Harry asked.

"Their stock is going through the basement even as we speak," said Elsie. "And the SEC is considering suspending trade in it."

"I guess without an import license, Mass-Rik Imports doesn't have much of a future."

"True," Elsie said. "And that leaves us with one small unfinished piece of business."

"The device."

"The device. Except that it's already too late."

"Too late?"

"I already got rid of it." Elsie's face

wrinkled up with concern, but Harry was quick to continue. "I gave it to the boys in the lab at MIT. I told them to move as much of their equipment as they could carry to someplace safe, then have a party with the thing."

The concern in Elsie's face was replaced with distress.

"Oh dear," she said. "I suppose we can get Mr. Dean to retrieve the device for us—just like he did before."

"I doubt it," Harry said. "It's probably not working by now. They said the first thing they were planning to do was strip it down to its component parts. By now, they're probably up to their armpits in Rik technology."

"That's quite a dilemma," Elsie said. "It's not what our policy is at all."

"No, it certainly isn't," Harry said. "But I think Victoria's father was right. I don't think your policy makes a whole lot of sense. One reason we weren't ready for the 21st century is that too many people hid from reality. And Rik technology is reality. If we don't prepare for it now, as fast as we can, we're going to go the same way as Naverly Tol. And that means making the leap from where we are now to where the Riks are as quickly as we can."

Harry reached into his pocket and switched his think-man on. The reassuring sound of the system booting up filled his ears. Elsie's eyes had grown wide and her jaw seemed to hang just a little bit loose.

"Victoria and her father wanted to exploit the changes the Rik brought us," Harry continued. "That's bad enough, but what you're trying to do is worse. You want to stop the change. And not only is that unwise, it's damn near impossible. Next time, it won't be Victoria's father, but there will be a next time and it will be someone. If you aren't ready for it when that happens, maybe we aren't any better than the Tolians. But I, for one, don't plan on spending my future working for chefs in the desert digging up grubs for the salad."

He searched the menus for some good background music.

"Now, if we're all finished, I'd like to get back home. I have a travel guide article I need to write." ■

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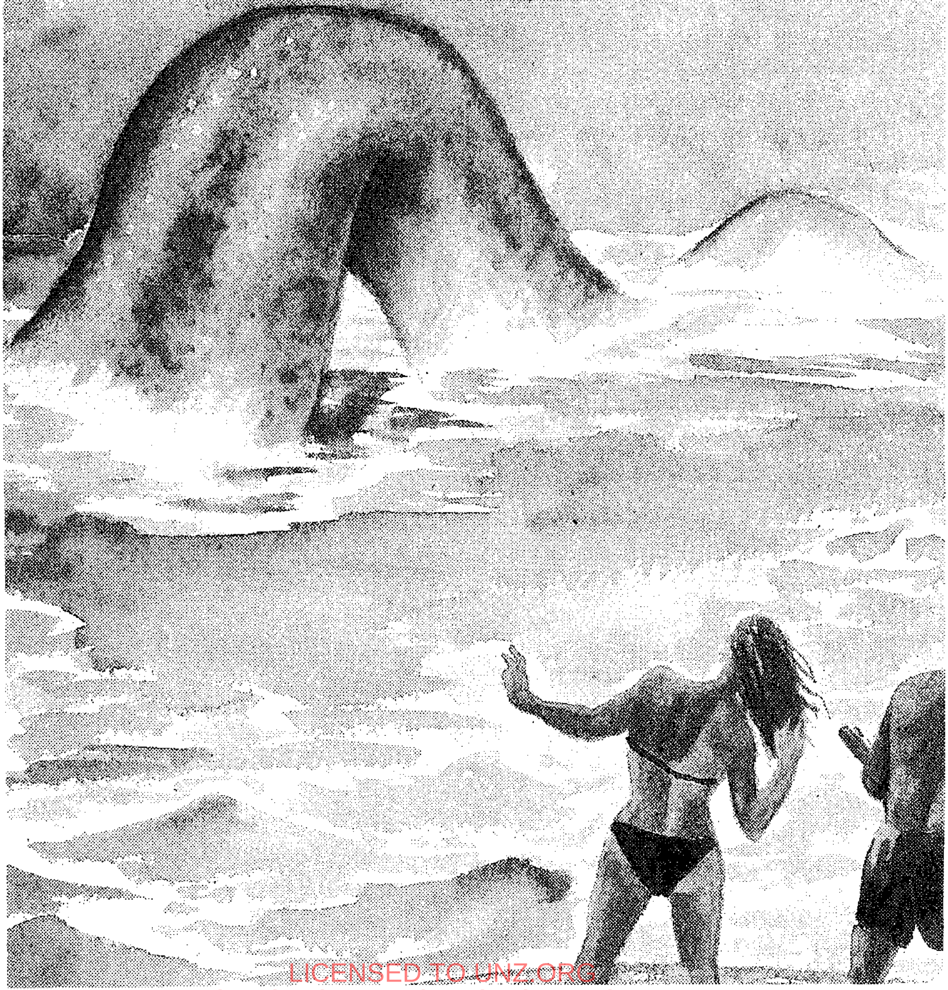
A MONSTER'S TALE

Sometimes a research tool plays a quite unexpected role in the work. . . .

Illustration by Steve Cavallo



They started off with him seeing her naked.

Kelly Lindsey often sunbathed in the nude. The *Flying Witch* was her boat after all, all sixty-five, high-powered feet of her. With the canvas blinders up, one would really have to be determined to catch a glimpse of her from the dock. And the handgun she kept next to her drink on the stand kept her from feeling naked.

The Sun had bleached out even the minor traces of brown in Kelly's hair, and baked her skin to a warm bronze. She was far too beautiful to be taken seriously on first sight, except during those few months when she'd worked as a stripper in Florida—just out of high school and eager to be on her own. But that was six years ago. She had a better way to make money now, and it was usually legitimate.

"Knock, knock. Anyone home?" The voice came from behind her.

Kelly flipped over and out of her lounge chair, in the same movement pulling her gun off the table and training it on the man standing there. She didn't care one damn bit that she was nude.

He didn't either, not with a gun pointed at him.

"Hold it, please. I'm sorry. I'm Dr. Fred Fryling. Your passenger? You know? The cruise line hired you to take me around."

Slowly she relaxed her grip on the gun, though she didn't drop it yet. "Next time you want to come on board my boat, you holler from the dock first. Got it?"

"Yes, ma'am."

Kelly put on her robe, not tying it particularly tight, and offered Fred a chair. "I have a few questions I ask clients, Dr. Fryling."

"Please, call me Fred, unless you expect me to call you 'Captain.' "

"OK, Fred. I want to know why the cruise line hired my boat. They were adamant that no other boat would do."

"Because you're the only person in the Caribbean who owns a charter boat with an MHD drive. A big drive, too, for a boat this size."

"I see," Kelly said. "So where's your cargo? Can you load it by yourself, or should I help you?"

"I don't have any cargo. I mean, not anything other than my luggage and some special equipment. What kind of cargo do other people bring?"

"That's a question I try not to ask," Kelly said. She looked over her passenger again. He was quite attractive, she decided, though she wondered if he could even find his ass with both hands. And a doctor, too. Wouldn't mom be happy if she could hook up with someone like that—instead of having her remain a vagabond independent shipper. "What kind of doctor are you?"

"I'm a marine biologist," Fred answered. "That means I don't drive a Porsche. Sorry to disappoint you."

"Don't flatter yourself, Fred. I've had this pain in my ass ever since you came on board." Then she burst out laughing and he joined in.

"We didn't get off to the best start, did we?" Kelly said.

"No. But I think we'd better learn to get along if we're going to hunt sea monsters together."

"What did you just say?"

He explained it to her over drinks in the galley, after she'd dressed in shorts and a bikini top.

"I was on board the cruise ship *Caribbean Lady,* on one of those gambling, drinking, and dancing cruises. The *Lady* happens to be a huge MHD drive ship. By the way, do you know how your drive works? The principle of the thing?"

Kelly set down her drink and used a napkin to wipe perspiration away from between her breasts. "Why, no. Why don't you tell me?" She was watching him closely. He failed to notice her sarcasm. Yet there was something about Dr. Fred that she either loved or hated, though she couldn't tell which.

If you have a magnetic field pointed the right way, Fred explained, and you have a wire in the field with a current going through it in the right direction, the wire will be repelled. In the case of the magnetohydrodynamic drive, you run current through conductive sea water as it enters the drive tubes. The superconducting magnets cause it to be repelled out the back. "Simple physics, but the Japanese own the patents, and they're cleaning up," Fred concluded.

"Fine. But you missed the part about avoiding freshwater outflow from big rivers. It wrecks conductivity," Kelly put in, smiling.

Fred looked at her, said, "Well . . ." and continued telling her about the cruise. "We were well on our way to Rio when there was a bump during the night. The engineering crew noticed a loss of efficiency in the starboard drive tube. Captain Porter ordered us to continue on at one-half speed and in the morning had one of his guys dive down to inspect the starboard tube. The outside looked OK so they told him go inside. On the *Caribbean Lady* that tube is thirty-five feet across."

"What was inside there?" Kelly asked.

"There's only supposed to be a few trim fins to control the water flow. The captain thought there might be a tree trunk—one of those big ones that sometimes come floating out of the Amazon—stuck in there. But what they hauled out looked like a twelve-foot-wide section of green plastic sheeting, but with scales on it."

"Scales?"

"Yeah. That's where I come in. I was jogging on deck that morning and saw them pull it out of the water. Captain Porter wondered if it was a fin from some kind of squid or big fish. I told him it was like nothing I'd ever seen."

"What did he say to that?"

"Nothing. Another guy came over from the crowd that had gathered. I recognized him from the night before. He'd been barfing drinks over the side. He told us what he saw when he was throwing up."

"And what did the drunk say he saw?"

"A sea serpent. A long, thick, snaky, dragon-headed sea monster. Said it reared up fifty feet out of the water then dove back under, and that's when the bump came.

"So that's the story. The captain reported it, a cruise line rep came out to look into it and decided there might be a good advertising angle here if the line could substantiate things scientifically. Since I was qualified and already knew everything, he hired me on the spot."

Kelly got them each another margarita. "OK, Doc, now I know why you're hunting sea monsters. But why *my* boat? The *Witch* is fast, but she's hardly unique in that department."

"Your MHD drive, Kelly. My theory is that the sea serpent came by our ship because it was attracted to the engine's EM fields. Lots of water life is sensitive to electrical effects. Electric eels, for instance. Why not the sea beasty? And sea serpent reports dropped off markedly after the invention of steamships. Sea monster believers account for this by assuming that the things just plain don't like the noise. MHD drives are quiet."

"So you're hoping that my big engine will turn on any local sea monsters and bring them around? How big did you say this thing was again?"

"My guess is that it's between one hundred fifty and two hundred feet long, and probably fifteen feet thick at its widest."

"Aren't sea monsters supposed to crush ships and eat what they find floating in the water?" Kelly asked, then burst out laughing. "Fred, if I actually believed we'd find anything out there, I'd throw you overboard and cut out like nobody's business. But since I don't, I'll just take your money and ferry you around anywhere you want to go."

Fred frowned. "You don't believe me? Or that we'll succeed? Why?"

"*Why?* Because it's silly. I've been on the water for a long time, and I've talked to old people who've been on it their whole lives, and none of us have seen sea serpents. We have our share of strange stories, but no sea serpents. I've never heard of any scientific evidence—"

"What about the fin?"

"Could have been something else."

"How about what happened in 1930? The research ship *Dana* brought up something in her nets. A Dr. Bruun dissected it and determined it was a six-foot-long *larva* of some kind of giant eel."

"I never heard of that."

"Neither did I until I looked. Science is often like that. But the bottom line is, it's a big ocean. And there don't have to be a whole lot of them in it. They could have been missed."

Kelly sighed. "There don't *have* to be any." She put their drink glasses in the sink. "Stow your gear, sailor. You get the port cabin. The bow is mine. You're not allowed in there unless I invite you." She smiled. She noticed that he didn't return it.

Even though he was almost twenty years her senior, he was handsome, and likable. And he had a driving passion, too. She liked that. OK, so he *could* find his ass with both hands. He might even get a chance to find hers, she thought.

The first few days of the expedition, as expected, were uneventful in terms of monster hunting, but pleasant in other ways, Fred had to admit. He'd come aboard in San Juan, Puerto

Rico, and they'd set off down the chain of the Lesser Antilles. The *Flying Witch* really could fly, pulling fifty knots if need be, and Kelly enjoyed showing him just what her boat could do.

He asked her once how she'd managed to acquire such a fine boat. She'd frowned, then said, "I upheld my end of the bargain, and the man I got the boat from upheld his. And part of the deal was that I wouldn't talk about it." She took him below deck and showed him a closet, inside of which was a small arsenal, everything from pistols to a double-barrelled shotgun. "I also have a machine gun mounted on the bow. That's that thing wrapped in canvas up there," Kelly said. "I have these things for a reason. Piracy on the high seas isn't dead yet."

"Ever had to use any of this stuff?"

"No. But the *Witch* is my life. Nothing and no one is ever going to take her away from me." The grim, determined passion in her answer Fred found revealing. This was more than a boat to Kelly. The *Witch* was home. But Kelly was young—Fred wondered what had happened to her previous home.

They stopped in Guadeloupe, and Kelly took him to a restaurant she knew. Another docking in Grenada allowed Fred to make it even by getting her a genuine souvenir of the invasion of three decades previous.

The Caribbean nights were spectacular. He'd never seen the sky so black nor the stars so capable of bejeweling the heavens.

It was hard for him not to think about Judy and Joy as he looked up, wondering if their souls really were out there somewhere. The accident that had taken his wife and daughter away was ten years behind him chronologically, but only chronologically.

Which left the final pleasure, that of the captain herself. She was spunky and sharp. And a tremendous delight to watch walking along the deck in clothing appropriate to the climate. Which only made it harder to conceal both the fact and the bitterness of his decade-long inability to close the emotional wound and put the past behind him. A few times he'd been certain that Kelly was open to an advance, to which he had studiously pretended obliviousness. Good thing he had work to do out here. Work had been his savior since the deaths.

They stopped in Trinidad to top off the batteries. "We're good from here to Africa, now," Kelly said after the charging cables were removed. "But we've been a little short of sea monsters so far."

"Actually, the *Lady* was about a hundred miles off the north coast of Brazil when we had our encounter. I never expected to meet up with one in the Caribbean," Fred said. He called up the charts at the nav station. "Here," he said, pointing. "We'll follow this course down the South American coast for a thousand miles. Then we'll do a slow drunkard's walk back toward the Lesser Antilles."

Eight days without a bite, Kelly thought. Not from a sea monster, and certainly not from Fred. The failure of a sea serpent to show itself was expected. Fred's failure to take advantage of his situation was not.

Contrary to what the sailors in every Caribbean port thought, Kelly was not a bed hopper. Her brief time as a stripper was not indicative of the girl she had been before, nor of the one she had become, though she rather enjoyed the image that had been attached to her. Still, her relationships tended to get physical very quickly. She was not one to put off the inevitable.

As the days slipped by, she'd found herself more and more attracted to her passenger. She'd been delighted along with him when his scanners seemed to pick up something big following below them, and shared his disappointment when the echo would simply dissipate into the deep blue. She laughed at his initial fear during his first ocean storm on such a small craft, but was impressed with how he overcame it and helped her secure the *Witch* for the weather.

He was a decent man, a genuinely nice guy, in a world that knew too few.

They were returning to Trinidad, would be there the next morning, when she caught up with Fred sitting with his feet hanging over the side. She sat next to him. "Looks like the mighty fisherman is heading back with an empty bucket," she said.

"Sure does," he replied. "Too bad, too. I really had my hopes up. I just hope the line will finance another venture like this."

"So do I," she said.

"You? I'm surprised. You never believed we'd find anything anyway."

She paused a moment, then said: "But I did find something." She reached to put her arm around his shoulders, and felt him stiffen and bristle.

She jumped up in frustration. "OK, what the hell is the matter? Are you married? You don't have a ring! Are you really not attracted to me? What?"

"Fear," he said, almost inaudibly.

"What?"

"I lost my wife and daughter in a car accident ten years ago and I haven't been able to per—have a relationship since. Does that help? Yes, I find you attractive. Incredibly so. Any other man would fall all over himself to be with you." The reemergence of long-suppressed anger and frustration had brought tears to his eyes.

She was able to hold him, then, in a warm embrace that promised nothing except that she understood and cared. He was invited into the bow that night.

And even though fears of impotence (memories from a relationship attempted too soon after the loss of his wife) went unrealized, for the first time in her life, Kelly understood how unimportant the physical side of love could be.

They docked the next morning in Port of Spain, Trinidad. While Kelly took care of the recharging, Fred left to head into town. He'd told her that he needed to contact the cruise line because he had an idea that might get them another charter right away.

After last night, Kelly was eager to give Fred his chance, though she wished he'd been more forthcoming about what his idea was.

He returned with a bounce in his step. Kelly hoped at least some of that bounce was the result of the fireworks from last night. "We've got another charter," he said.

"Great. We leaving soon?"

"No. Not until next week. I've already got my plane ticket. I stopped at the airport on my way back."

Kelly tried to take the news in stride. "You're flying out from here? You aren't even going back with me to Puerto Rico?"

He put his hands on her shoulders. "Listen. You're very important to me, Kelly. I'll be back. Soon. But I thought of something last night that may help me catch my sea serpent, and—"

Again her heart softened. "It's OK," she said. "Go and do what you have to do. I'll wait for you here. But one thing. . . ."

"What?"

"It's *our* sea serpent now."

The weather stayed beautiful the entire time Fred was away, but Kelly found few reasons to leave the *Flying Witch*. Once she ventured out for groceries, and on the way back from the store spotted a voodoo shop, offering fortune telling, genuine souvenirs, and something else that really caught her eye—aphrodisiacs. She was tempted to go in and see what was being offered, actually took one step, then caught herself and decided not to.

She returned to the boat. She wasn't interested in sex with Fred. She wanted to concentrate on lovemaking.

Finally the time came to get him from the airport. She threw her arms around him in the terminal with a vigor even she hadn't expected.

"Hey, I missed you, too," he said. "But I can't hug you with my hands full." He was carrying one small trunk in addition to his suitcase. Kelly could hear something sloshing inside.

"What's in there?" she asked.

"Perfume by the gallon."

"For me? You shouldn't have. *Really*."

"Sorry, Kelly. It's for another woman. I'll tell you all about it on the boat."

"That night we spent together, after you fell asleep, I got to thinking," Fred said. "Maybe our sea monster has a mate. Follow this for a minute. We know there can't be too many sea monsters in the oceans, or they'd be a well-known species by now. Also, the oceans are huge. If our sea monsters want to procreate, they're going to need some way to link up with each other. They may even mate for life, but it might not be necessary."

"Did you use to explain things to your students this way?" Kelly said from the galley stove. "Start by telling me what's in the bottle."

"You have no sense of drama," Fred complained. "OK, it's sea monster cologne. Concentrated synthetic sea monster scent. I figured out that our beasties must either find each other by scent or by electrical effects, which would explain why they're attracted to our engines. Of course, it could be sound, too, but I can't do anything about that. Then again—"

"Fred?"

"What?"

"You're just playing another hunch. Admit it."

"You're right," he said. Kelly came to him and sat on his lap. "I wanted an excuse to stay with you a while longer."

"You could have just asked, you know."

"I don't think the Dean of Sciences would have granted me a leave of absence just to go boating with you." She gave him a deep kiss. Upon surfacing, he said, "Although it certainly would be in my best interest."

They set out early the next morning, and followed the same route they had before. After lunch, a couple of days later, Fred hauled out his jug of scent. "I had them whip this up for me in the biochem lab. They made it from scrapings off that chunk of flesh from the *Lady*'s drive tube."

"How are we supposed to use it?" Kelly asked. She'd been admiring Fred all morning. She tried to conjure the image she'd had of him when he'd first come on board, but she couldn't do it while looking at him now. Though he was only slightly more tan, and perhaps a pound or two lighter, she saw him through different eyes now.

"I guess I'll try swabbing some on the sides of the boat. We're in uncharted territory here."

They brought the boat to a halt. Fred wanted to jump in the water and have Kelly hand down a sponge full of scent, but she nixed the idea.

"No way. You're more likely to attract sharks with that odor than you are hypothetical sea serpents." He settled for dabbing the sides with a sponge attached to a pole.

The rest of the afternoon they enjoyed the sunshine as they scanned the horizon with binoculars. The ocean was remarkably calm, and it was like a casual day of power boating on a lake.

"It's about time we turned in," Kelly said after the tropical Sun had finished making its descent. They were throttled down to two knots. "And no argument this time. You're sleeping in the bow with me. I bought your little 'I'm real tired from traveling' speech these last few nights, but I'm lonely." Kelly pressed up against him. "I want your companionship."

"Is that all?" Fred asked.

"No."

He laughed, then hugged her, kissed her. "You're way too good to me. You go ahead and get ready. I'm going to put more scent on the sides and take a shower."

As promised, he joined her in her bunk a short time later. It was even better than the first time.

Later, lying there in the quiet, Kelly started to talk.

"There's only one thing in my life I'm really ashamed of," she said.

"What's that?" Fred asked. "But before you say anything, you don't owe me any confessions."

"You're the first man to ever make me realize how much I wanted to."

"OK."

"It's about how I got this boat. You asked, remember?" She saw his outline nod in the dark. "I never got along with my mom. She and dad divorced when I was twelve. He was a cop. I left home at eighteen to be out on my own. I made a mess of it, did drugs, woke up in an alley some mornings. But I had too much pride to go home. Eventually I wound up as a stripper in Miami. From there a man . . . oh, hell, might as well call him what he was—a drug lord—spotted me and took me away to live with him.

"I hated it. I was a kept woman. It was worse than living with mom. I wanted out. But he wouldn't let me."

"How did you escape?" Fred asked gently.

"He'd been hit hard by the narco cops. He needed money and had a huge load of white stuff ready to hit Puerto Rico. He had a fast, quiet MHD boat, called the *Santa Maria* then, ready to take it in. But no driver—he'd lost them in a raid. And, and. . . ."

"And so you did it."

"Yes. I told him I'd take it in for my freedom and the boat. I'd learned a lot about boats while I was with him. He knew I had a good chance of making it. I did. I called him afterward, he told me where he'd left the *Santa Maria*'s ownership papers for me, and with them he left me an additional ten thousand dollars—" Kelly stopped as her voice caught.

Fred held her tighter. "A week later I got a card from mom telling me my dad was dead. A shoot-out during a drug raid."

"Over the shipment you brought in?"

"I don't know. It doesn't matter. But it made me realize that other people had to pay the price for my freedom. That's why the *Witch* is so important to me. She's what makes me free. I hold her in trust for everyone who lost blood because of me."

WHOOMP! WHOOSH! KERSPLOONK! SPLASH!

"What the hell was that?!" Fred exclaimed as the tossing of the boat threw him out of the bunk.

Another wild jolt and Kelly joined him on the floor. "I don't know," she said. "A storm? But I don't hear any wind, and the weather was supposed to be clear all night."

The *Flying Witch* was rocking too much for them to regain their feet, and they had to crawl to the hatch and up the stairs to the deck.

"Oh my God!" Fred exclaimed.

The head of the sea monster was something of a cross between a horse and a snake, Fred decided, though much larger than the biggest version of either. The mouth was open and four rows of sharp teeth gleamed in the moonlight. The head, easily four feet across, towered high above the deck. But what was more important to Fred was that he was staring at it from only twenty feet away.

"Kelly! Quick! Hit the engines. We gotta make a run for it!"

Though Fred had pulled on his pants before heading up to the deck, Kelly had followed in the nude. This was one of the few times she really felt naked. "I'm sorry I didn't believe you, Fred," she said in awe as she watched the huge head dive back below the waves. Three huge loops of sea monster appeared above the surface, then submerged with the reappearance of the head, a football field away, but turning once again toward them.

Kelly was at the controls when Fred reappeared with his videocam. "Get us moving. It's looking for its mate, I'm sure. Either that, or it's stupid enough to think *we're* its mate."

The *Flying Witch* sprang away as Kelly pushed up the speed. The monster followed along behind them, seeming to have no trouble at all keeping up. She pushed the lever up for more speed: twenty knots; thirty; forty! and it was still keeping up. "OK, I'm going full out, Fred!"

Kelly eased the speed upward. Somewhere around forty-five and forty-six knots the monster was unable to gain on them, though it still wouldn't give up the chase. Fred kept his camera fastened on the creature, nervously checking and rechecking the power supply and the REC light. He had no intention of being just another case of someone who had mishandled the camera when the find of the century was at hand.

The Sun came up an hour into the chase, which went on hours more. Kelly finally put on some clothes when she was satisfied that the creature wasn't going to suddenly put on a burst of speed so that her hand would be needed at the helm. Fred continued to record the creature and had talked to Kelly only when he needed the freshly charged spare power pack or another video disc.

While he watched, Fred noticed regularities in how the creature moved. First the head would go down, then the humps would disappear, one, two, three. After ten seconds the head would clear the surface again, the humps would again reappear in sequence, then the head would dive again. Fred also cranked up the magnification of the camera and tried to determine how the creature should be classed. Did it have gills, or did it breathe air? He thought he saw gill slits along the sides just back behind the huge mouth. It seemed unlikely that such creatures would have to regularly surface for air. They certainly would have been documented before now if they did.

He wondered what it would eat. Those teeth were sharp, but the jaw didn't seem designed well for chewing. Perhaps the great serpent killed and swallowed its prey whole. That would account for why no whales ever turned up with huge round bites taken out of their hides.

And the creature's stamina was unparalleled.

"Geez," Kelly said after a while. "That thing's been following us for two hundred miles. Doesn't it ever get tired?"

"Staggering, isn't it?" Fred said, finally setting aside his camera to talk to her. "I've been wondering if maybe it travels something like a kangaroo does. You know, a kangaroo is able to use its legs like springs, so it can use energy efficiently. Maybe this thing does much the same, though I don't know how it would work."

"What are you going to name it?"

"I hadn't thought about that. Maybe '*Serpens Kellias Giganticus*.' "

"That'll be something to tell my mom: 'My boyfriend named a sea serpent after me.' But aren't there standards for that kind of thing?"

"Sigh. There are, Kelly. Sorry," Fred said. "I won't even be able to think about a name until I find out if it's from a known genus."

They'd been running about a quarter mile ahead of the serpent, but suddenly Fred noticed that it seemed closer. "Is our friend gaining on us? You didn't cut back the power, did you?"

"Of course not. I haven't touched the controls in hours."

"Well, it's gaining on us. We'd better see what's going on."

After a brief look, Kelly saw that their speed had indeed fallen, and their power consumption kept fluctuating. "Something's wrong," she said. "We're losing speed, but there isn't any reason we should be. Engine diagnostics check out."

With that comment, the *Flying Witch* suddenly seemed to lose power altogether, and the engine shut off. A telltale red light was blinking. "What light is that?" Fred asked.

"Water salinity. It's never come on before. I don't know why . . . oh, *dammit!* Where are we, anyway?" Kelly raced to the nav station and called up their position. In an instant, positioning satellites told her where she was to within a meter. "Shit!"

"What is it?"

Kelly pointed to the map. "The Amazon. I forgot about the Amazon. Outflow, Fred. Fresh water gets dumped out of the Amazon river by the megatons and desalinifies the ocean way farther out than you'd expect. The water isn't salty enough for my engines!"

To emphasize her words, the boat suddenly started rocking violently, and from outside they heard a deafening, monstrous scream, as if the serpent was signaling its victory to the world.

"We're in deep shit," Fred said.

"Hell, no! Not if I can help it," Kelly exclaimed.

The boat was shaken by a solid thump which threw both of them to the floor. Kelly sprang up and raced to the arsenal closet, pulled out a large and obviously heavy box. "Help me carry this!"

Fred joined her, took the box away and found that it was ammunition.

Kelly answered the question in his eyes. "For the machine gun on the bow. Let's go!"

Fred carried the box and Kelly ran ahead. She pulled the knots loose and unwrapped the tarpaulin from the gun. She pointed to a gaping hole in its side and Fred realized that the ammunition box was meant to slide in. With an effort he lifted and shoved it into locking position.

The sea serpent was coming back around. The head rose high above the water, then dove below, and there followed the dance of the humps.

Kelly lowered the gun into position and was trying to take aim. The tail had just disappeared below the waves. "Where is it going to come up?" she unfairly demanded to know, swinging the business end of the gun from side to side.

"Can't tell you, but I'm getting the life jackets. We may have to abandon ship. It probably just wants the boat anyway because of the scent. It probably won't even notice us."

"Bullshit. Besides, we're going to have one dead sea monster in a minute. This boat is my life. I'm not giving it up without a fight!"

They waited. Seconds turned into a

minute turned into two minutes.

"Well, where is it?" Kelly said, not even noticing her white knuckles as she gripped the handles.

"Maybe it left," Fred answered.

"You really think so?"

"No."

A huge head rose out of the water to a height of forty feet right in front of Kelly, right in her gunsights. Too startled to fire, she stared for an instant, and the head whipped down and smashed onto the deck.

She fell to her knees, but clung to the gun and quickly pulled herself up. The sea monster lifted its head for another blow. Kelly let loose with a burst. She could see from her tracers that she was missing, but she turned the stream into the green hide looming before her. The slugs tore into the flesh. Huge scales came shattering and flying off. But for all that, the welts that remained didn't seem to bother the serpent more than needle pricks. It turned aside and belly flopped onto the water.

Its head almost flattened Fred.

"Fred! My God, Fred!" Somehow he'd been knocked overboard. Fortunately he had slipped his life jacket on as he was bringing Kelly's to her. He was bobbing about in the water.

"Fred!" Kelly screamed.

He didn't answer, didn't even wave an arm. He could be dazed, she thought. He wasn't even trying to paddle away from the monster.

Again Kelly trained the machine gun on the side of the creature and fired. It seemed annoyed, but it was concentrating on Fred.

Kelly checked her ammunition light. She had enough for one more decent burst. That was all. There was another box of ammo down below, but she didn't have time to get it, nor anything else in the arsenal locker.

When she looked up again, she saw Fred moving. "Fred! Fred!" she called, but he didn't acknowledge. He was alert enough to his situation that he was squirming out of his life jacket. He was a sitting duck bobbing around on the surface.

The monster tried to strike at Fred, but he disappeared beneath the surface, coming up a few dozen feet away ten heart-stopping seconds later. The great beast was too massive to alter its movement midstrike, chomping on the life jacket, but slowly recoiled for another.

Though the episode could not have lasted for more than a few minutes, to Kelly it was an hour of agony. How best to use that last burst?

The serpent made another stab at Fred, and again he evaded, but even from the boat Kelly could see that he was tiring.

She clicked the lever to single shot, carefully aimed and led her target, and fired a shot that missed the eye she was aiming at but buried itself in the sea monster's snout. It bellowed deafeningly, then turned aside from Fred and came for the *Witch*.

"Steady. Steady," Kelly said to herself. When it got close, she'd go for the eye again. She watched it approach through the sights, carefully lining up her shot. She didn't want to miss. She couldn't.

She was too cautious. The monster

came faster than she thought and startled her. The jaws came down in a streak, she twisted away, and the loud, sharp *snap* of the jaws closing told her that it had missed.

Almost. In getting away Kelly had rolled under a deck bench. As she watched the creature, it seemed puzzled at being unable to find her and turned away. It was then she noticed blood flowing from her left arm below the triceps. The gash would need care, but it would have to wait.

Kelly crawled out from her hiding place. While the creature had been pursuing her, Fred had returned to his shredded life jacket, was clinging to it. He saw her looking at him and waved that he was OK, even as the monster was again heading for him.

Kelly returned to the machine gun. Her left arm was going numb. She knew her aim would be terrible.

How many more dodges did Fred have left in him? she worried. *Don't be a fool! He's dead unless you do something.*

Dead in a gruesome way—chewed to death.

Kelly couldn't let that happen. She had one burst left. She loved him.

Slowly, she swung the muzzle of the gun in his direction.

He must have seen her, must have known what she was doing. He was screaming something.

The serpent had dived down below and come up on the far side of Fred. The head rose high, Fred abandoned the life jacket, and it came down in a mighty splash upon the jacket.

Kelly again trained the gun on Fred.

He was screaming at her while desperately trying to tread water. *God, he must be exhausted.* She could hardly hear him. What was he saying: "Oot the itch?" No, "shoot the bitch," that had to be it.

The three humps of the monster were close to disappearing. The head would be up again in seconds.

Kelly was lined up on Fred. She listened to his screams—they'd be the last things she ever heard him say. She knew the words would haunt her the rest of her life—shoot the bitch.

Only now it sounded more like "shoot the witch."

Or did he mean the *Witch*?

Could he mean. . . ?

Kelly turned the gun around, pointed it at the deck, and let loose with the last burst.

The bullets ripped the hell out of the deck. Splinters of wood flew all around her. The racket was deafening, the sound of the slugs impacting reverberating and resonating throughout the *Flying Witch.*

And the ocean below.

The tracers had set small fires. The *Witch* was dying. But Fred was swimming toward her.

And the serpent was gone.

She helped Fred climb up the ladder into the boat. She wrapped her arms around him but he pushed her away. "We have to put out the fires," he said.

The extinquishers made short work of the flames, and they found themselves on a listing boat. The *Witch* had self-sealing compartments, so they'd stopped taking on water. But Kelly knew her boat was dead—the compartments that did get flooded were vital ones.

Their SOS had been acknowledged, and they were waiting to be picked up. Less than ten minutes had passed since the ordeal.

"I'm sorry about the *Witch*," Fred said.

She sighed and leaned against him. "I guess there was someone who could take her away from me. How did you know that shooting the boat would work?"

"I didn't," Fred said. "But you were being braver than I was."

Suddenly, off the port side, the sea serpent sounded, its body coming fully a hundred feet out of the water before splashing down.

And then another one did the same.

"Look!" Kelly shouted, pointing. "Not again."

But the two sea monsters seemed oblivious to them, and after swimming side by side for a few hundred yards, humps in harmony, they dove and were gone for good.

"Did you notice that the second one was missing a fin?" Fred asked.

"Our monster was looking for its mate?"

"I think so. Maybe the scent did do the trick."

"It must be nice to have someone who'll come looking for you," Kelly said.

"It is," Fred said. Then: "You'll come with me, won't you? I mean, your home is gone. And I love you. And—"

Kelly put her finger to his lips to quiet him. "Of course I'll come with you, Fred. But I want you to meet my mom first." ■

(Biolog continued from page 60)

was to conduct a dialog between rigorous modern science, especially physics and biology, and intellectually honest theology. This shows how the modern mind conceptualizes reality.

M.A. in hand, Alexis returned to Houston to work out this mind and matter duality in the pages of an SF manuscript. Immediate rent-paying evolved into a half-time position at the Rice University library. She is a "standardized patient" at Baylor College of Medicine, pretending illnesses according to various scripts in a training process for medical students. Working in a research library at a science-engineering school was, for an SF writer, like being Br'er Rabbit flung into his natural habitat of a briar patch. Not scientist, engineer, or theologian, she consults with people who are, plus anyone else interesting she runs across.

Her first story ever appeared in the June, 1990 *Analog*, followed now by five others, four receiving covers. A novel is under consideration by a publisher, with a second currently being written. These have been tech-reviewed by space physicists, shuttle engineers, pilots, a molecular biologist, a computer scientist, and an astronomer. Alexis wants to make her stories feel right to scientists and engineers. The final review is by physicist Stan Schmidt at *Analog*, who does not let gobbledygook masquerade as plausible speculation.

IT'S ANLAB TIME AGAIN —PLEASE VOTE!

Your ballot will be automatically entered in our drawing for a free one-year subscription!

In case you missed the ballot in the Mid-December issue, once again we're asking you to help us via The Analytical Laboratory. Not only will your votes provide tangible awards for your favorite authors and artist, but your feedback will help guide our selections of what to offer you in the future. Your vote is important!

Look over all your copies of *Analog* dated 1995, or refer to the annual Index which will appear in our January 1996 issue. Pick your *three* favorites in each of the following categories: novella, novelette, short story, science fact article, and cover. If you're not sure about a piece's category, you'll find it listed in the Table of Contents for the issue in which it appeared, as well as in the Index. List your choices in order of preference (your favorite in each category is #1) on the ballot below, and either mail it in or send it e-mail. The ballot is intended to make it easier for you to vote, but if you don't want to cut it out, feel free to copy it.

To be sure your vote counts, please have it reach us by **February 3, 1996.**
Please, only vote once! Thank you very much!

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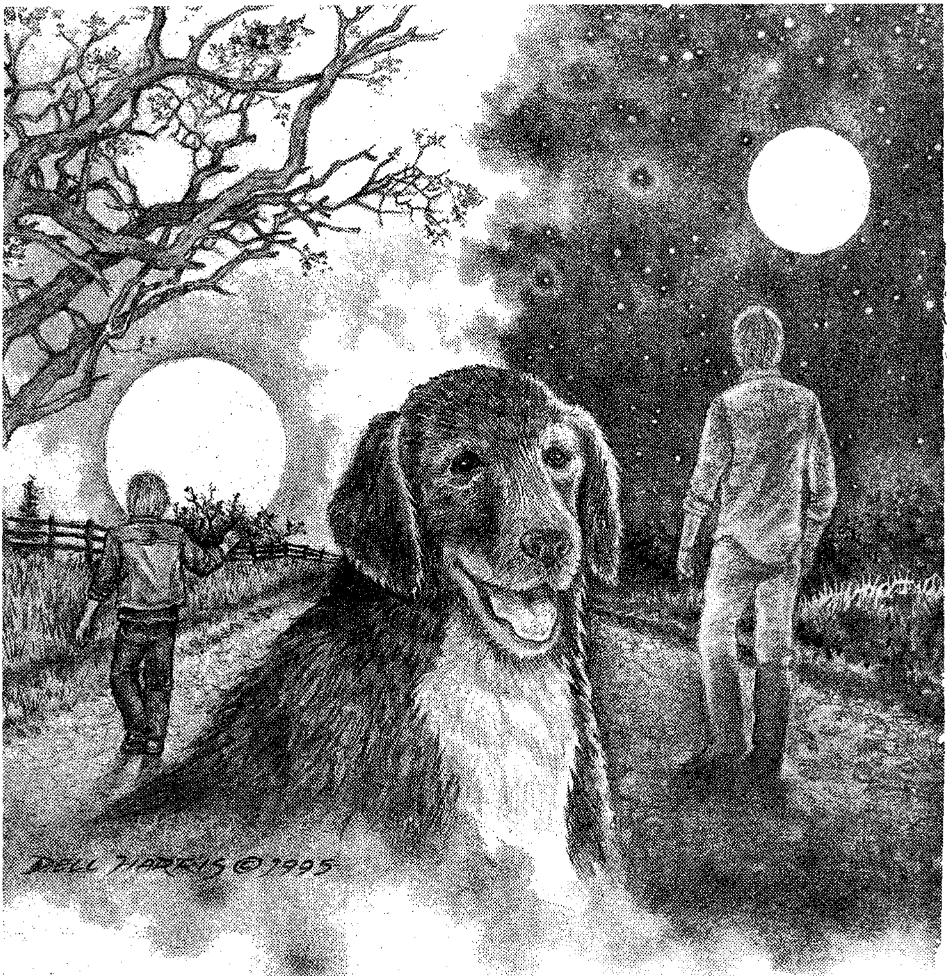
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Rob Chilson

TEDDY

Nostalgia comes to many of us eventually, but some can do a bit more about it than others. . . .

Illustration by Dell Harris

Off in the woods, foxes barked. Teddy listened alertly, but didn't bark back; they were far away. Suddenly he sat up from where he lay under the walnut tree, looking around the big, moon-lit yard.

"Woof?" he said.

The foxes answered, but that wasn't it. It had been one of Their noises, a metallic sound.

Then a Person came out of the barn, stopped and looked about.

"Woof? Woof?" It was more of a question than a demand; he was not angry, nor frightened. He knew better than to show anger toward a Person.

"Hey, heyyy, Teddy, don't wake the family."

Embarrassed, Teddy dropped his head and tail, his ears going down too. He wagged his tail so hard his whole body bent and straightened. It was the voice of one of his family. For him, the image of this one was quietness and affectionate tones and gentle touch, The Quiet One, whose love for Teddy was more openly demonstrated than anyone else's.

Then they were close enough for him to smell the other and Teddy checked in puzzlement. This was the Old One—no, it had to be The Quiet One—but he smelled like an older Person. Not the Old One—that one smelled of age and ill-health and smoke. Not the Other Old One—that one smelled of age and the tobacco he constantly spat. This smelled like The Quiet One, but grown up. Teddy whined in puzzlement. That very evening The Quiet One had said good night to him, and had smelled and sounded young.

"Quiet, Teddy. God, is it good to see you again, after all these years! Worth every cent I paid. Heyyy, Teddy, let's go for a walk—"

He understood "walk" and jumped with a yelp he instantly regretted, but The Quiet One didn't reprove him again.

"Come, boy! Come, boy!"

The Quiet One led him out of the yard, down the hill toward the creek and the berry patch. Teddy danced along with him, returning to him for frequent pats or ruffles of his long floppy ears, attentions that were never denied. For a long time they prowled among the wild blackberries, The Quiet One picking and eating berries, sharing some with Teddy. Because one of his family gave them to him, Teddy ate a few.

The Quiet One sat on the bank of the creek in the moonlight and talked to him for a long time, petting him and hugging him. Teddy panted with delight, his heart melting with pure joy. He licked The Quiet One's face when the latter lay back and looked up at the sky.

Finally they went back to the yard, where the Old Possum was mumbling around under the corncrib, but Teddy knew The Quiet One didn't care about any opossum. Long ago They had taught him not to bark at the small animals who shared the yard. The Quiet One walked very quietly now. He went over to the tractor and patted it affectionately, speaking to it much as he had to Teddy. Then the car, then he peered in the window of the henhouse, and finally back to the barn.

It was now very late and Teddy was a bit sleepy, but still game.

"What a picture you make, Teddy, with that black fur and white markings—lace shirt front, pantalets, and that half-and-half tail. Stand there—no, just stand there—stay—stay—" The incomprehensible murmurs went on, punctuated by pressure of the hands as Teddy tried to follow him when he backed away.

Then he made a very bright flash of light, but Teddy was only momentarily startled. People did things like that, and it was no brighter than lightning. There were faint mechanical noises, and The Quiet One stooped toward him. Teddy ran forward through the blotches in his vision, laughing with his tongue out, to be hugged.

"Goodbye, Teddy, goodbye. . . ."

Teddy whined at that, that was what they said when they went away and left him all alone. Whining mournfully, he followed The Quiet One into the barn. Teddy glimpsed a big Iron Thing there, not a car or tractor or anything he recognized. His hackles went up slightly; it smelled strange. It hadn't been there earlier. Teddy approached it cautiously to sniff, and The Quiet One patted his head one last time.

"Don't pee on the time machine," he said affectionately.

Then it was gone, and Teddy was looking at the wall.

He whined in puzzlement. He stood slowly wagging his tail, whined again in disappointment that The Quiet One was gone. However, he'd had doors closed in his face before—a mysterious thing, a piece of solid wall materializing from nowhere. But much that They did was mysterious. A little dog could only love and not bother his head with wonder.

He went back to his place under the walnut and dozed; the foxes were silent now.

Faint light, squirrels, and birds heralded day. The squirrels leaped from the big soft maples onto the roof, ran thumpety-thumpety across it, sprang to the pear tree and down to the ground, then scampered across to the walnuts, avoiding the tree Teddy slept under in summer. He watched them with enjoyment, but had learned long ago that his short legs put them beyond his reach.

Presently They began to move about in the house, and Teddy went to the kitchen door, where he ambushed Them as They emerged one at a time, some merely to look around, pausing to pet him and speak, others to stroll down to the outhouse, also not neglecting to pet and speak to him. To Teddy's puzzlement, The Quiet One smelled today as he had yesterday—last night he had become used to The Quiet One's new, grown-up smell. Big Cat came from nowhere, as was his wont, grandly ignored Teddy's offered nose, and was presently admitted to the house.

He smelled Their food, then he heard Them eating, and the Girl brought food for him—dry, as he liked it, not mushy. He crunched and gulped with great enjoyment, then went back and peered eagerly through the screen door. Big Cat was daintily chewing his food too, and gave him an expressionless glance.

Then They came out and moved purposefully about the yard, and to his delight began to work about the tractor, with much talk. Presently it began to bark like a dog, but very very fast. Teddy ran up in front of it, put his nose within inches of the inside of the wheel, and barked as loud as he could. The Big One, oldest of the three boys, cried, "Teddy! Quiet!"

He paid no attention. The tractor began to roll toward him. Teddy walked backward, still making the metal ring with his own barking. Suddenly it lurched and came at him faster. He backed hastily out, then reared up, put his front feet on top of the oncoming wheel. Walking frontward with his front feet and backward with his back feet, he stayed ahead of the tractor, still barking.

"Teddy!" yelled The Big One.

The tractor checked momentarily and Teddy took warning, was away before it came on even faster. It was too fast to get close to now—Teddy had been run over a couple of times by the light machine. He kept back but never stopped barking, pausing occasionally to laugh with tongue out at the younger boys in the trailer, The Quiet One and The Noisy One. The Old One and the Other Old One were in it also. The Noisy One suddenly jumped off it and ran at him as if to tackle him. Teddy barked at him and ran around in a circle, barking again at the tractor.

As he did so, he looked suddenly about for his Mother. It was she who'd taught him the joy of barking at the tractor, and running around it. But then he remembered—she was gone, he had not seen her in a long long time.

But the tractor was heading off for the woods, They were laughing and calling and yelling at each other. Teddy ran up to the tractor again, barking as loudly as he could, as loud as its own rapid-fire barking.

"TEDDY!"

Then he was startled by a thunderous bang. He leaped aside and paused; Teddy was gun-shy. Then he smelled black powder smoke, realized that The Big One was trying to scare him again with a firecracker. The tractor barked louder and faster, and so did he, racing around and laughing at The Big One.

"Hear us a quarter've a mile off," grumbled the Other Old One, spitting tobacco.

It was the beginning of another perfect day in a little black and white dog's life.

Teddy dozed more than normal that day, and that night, too, he was dozing when the light faded and the foxes began to bark. He awoke quickly enough then and was yelling back at the foxes when he heard a noise in the barn and remembered, with hope, that The Quiet One had played with him the night before. And sure enough, to his delight, it was The Quiet One who came out of the barn and ran to meet him, laughing quietly and grabbing his ears, jerking his head about gently and talking joyously to him. Again, to Teddy's brief puzzlement, he smelled grown up, but Teddy soon got used to it again.

They went for a long ramble in the

moonlight, and again The Quiet One spent much time sitting and talking, holding Teddy and patting him and ruffling his fur affectionately.

And in the nights that followed, while the Moon waned and faded, then waxed again, The Quiet One came out of the barn almost every night. But every morning he came out of the house, and by day he was young, while he was old by night. Teddy soon accepted this; who can fathom Their ways? Sometimes they went for long rambles about the Place at night, sometimes hanging about the fringes of the yard, sometimes walking up to the Road. But he never went into the house, or even near to it. And every day The Quiet One did the things he had always done by day. One night The Quiet One climbed into the tree where the boards were, and lugged Teddy up with much grunting and laughter, and they sat looking down on the yard and the house and barn and crib and henhouse all silver and ink in the moonlight. Then Teddy had a fleeting sense of how strange these nights were. But The Quiet One spoke and he lost the feeling.

And so the summer wore on, the Moon waning again and waxing. Now the days were shorter, the land dryer, the air rich and ripe and heavy with fruitful odors, the nights cool and dewy. The Young Ones began to leave the Place early in the mornings, in the Big Iron Thing, and return in the afternoon; the old rhythm, five days gone and two days home. The Quiet One came out of the barn less frequently at night, then still less frequently. Now at nights he seemed melancholy, and spent much time hugging Teddy. Then there was a chill in the air, finally one morning a frost, and at last he stopped coming out at night at all.

Some time after that Teddy ceased to expect him. He made a vague connection between the frosty nights and The Quiet One's nightly absence. But still he was there by day, always young. Teddy missed the nightly rambles and the attention, and sometimes felt lonely, as when he had lost his mother. But the mornings always came.

The nights got colder, and then it was winter, and that was good, too. Armored in his long thick fur and his fat, Teddy did not suffer from the cold. Every day They were out and about, and always They called to him and patted and fed him. Finally came a softening, a wetness of the air and soil, wind and rain: spring.

Then summer, and Teddy pricked up his ears at every odd sound in the night, expecting, then hoping, then gradually disappointed. All that summer, Teddy hoped, but The Quiet One did not come to play with him in the night.

The winter came again, and the summer, and the winters and the summers came and went, each season with its special joys. Never a summer came but that Teddy hoped The Quiet One would come out of the barn again in the night. He never forgot.

Meantime, The Quiet One was growing up in the days, his smell changing, his voice deepening. Teddy himself changed. Now he ran where once he had scampered, walked where once he had run.

One night of early chill he stood beneath the denuded walnut trees, feeling the chill of the ground beneath his pads, feeling the crispness of the air in his nostrils, hearing it in the distinctness of sounds, comfortably aware that it could not reach him through his fur and fat. But it reached him in another way, in the stiffness of his joints, the deliberation of his movements. As he sat propped on his front paws listening alertly to the barking of foxes that would in earlier years have sent him yelling defiance back at them, his mind wandered. Soon, he knew, it would be winter. It would be cold. And for the first time he could remember, he wished it different. He had always loved winter, too, but now he dreaded it. He wished summer would come again. He wished it was summer and that The Quiet One would come to him in the night.

They would go off to the berry patch, enjoying each other's company, enjoying the coolness after the heat, and he would laugh and leap and run and sometimes forget, and bark. And The Quiet One would pat him and ruffle his ears, and it would be as wonderful as it had been, that wonderful summer, the most wonderful summer he had ever known.

From these musings, he passed into a memory of his Mother. She had gone away a long time ago, when he was barely full grown. He was already bigger than she, before that. It was she who taught him to chase cars, but the family made him stop. He did not know what had happened to her. His confused memories included mourning and a mound of fresh earth, and the scent of death, but these things had so little to do with his memory of Mother—her bark, her joy, rushing crazily around the yard, each chasing the other—that there was no real connection in his mind.

To Teddy, Mother was still there, somewhere, in some confused way in the world as well as in his mind, if he could only find the way to her.

Teddy sighed, and the sigh became a mournful whine. If only he knew the way! He would go running (as when a pup he had rushed crazily around the house and found his Mother again), into the woods and come panting back into the yard as it had been then, the trees smaller and the house different, come back perhaps from behind the barn, and find Mother awaiting him there, her joyous bark, scampering puppy-like to meet him, tumbling in play, just as it had always been in his memory. . . .

Teddy sighed again and lay down, putting his nose on his paws. Off in the woods, the foxes barked as they had done when he was young. ■

Life is a tragedy for those who feel, and a comedy for those who think.

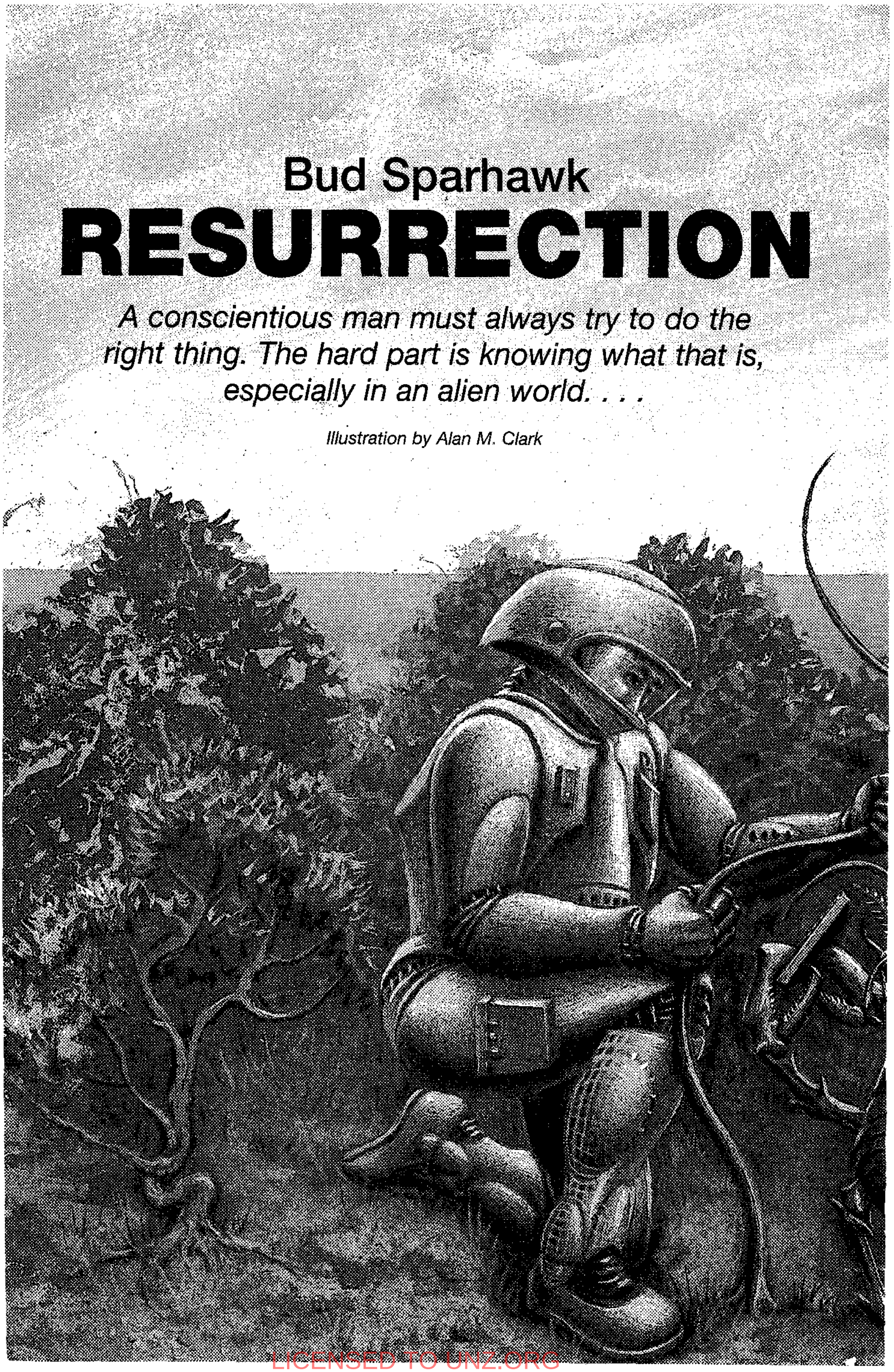
—Jean de la Bruyere

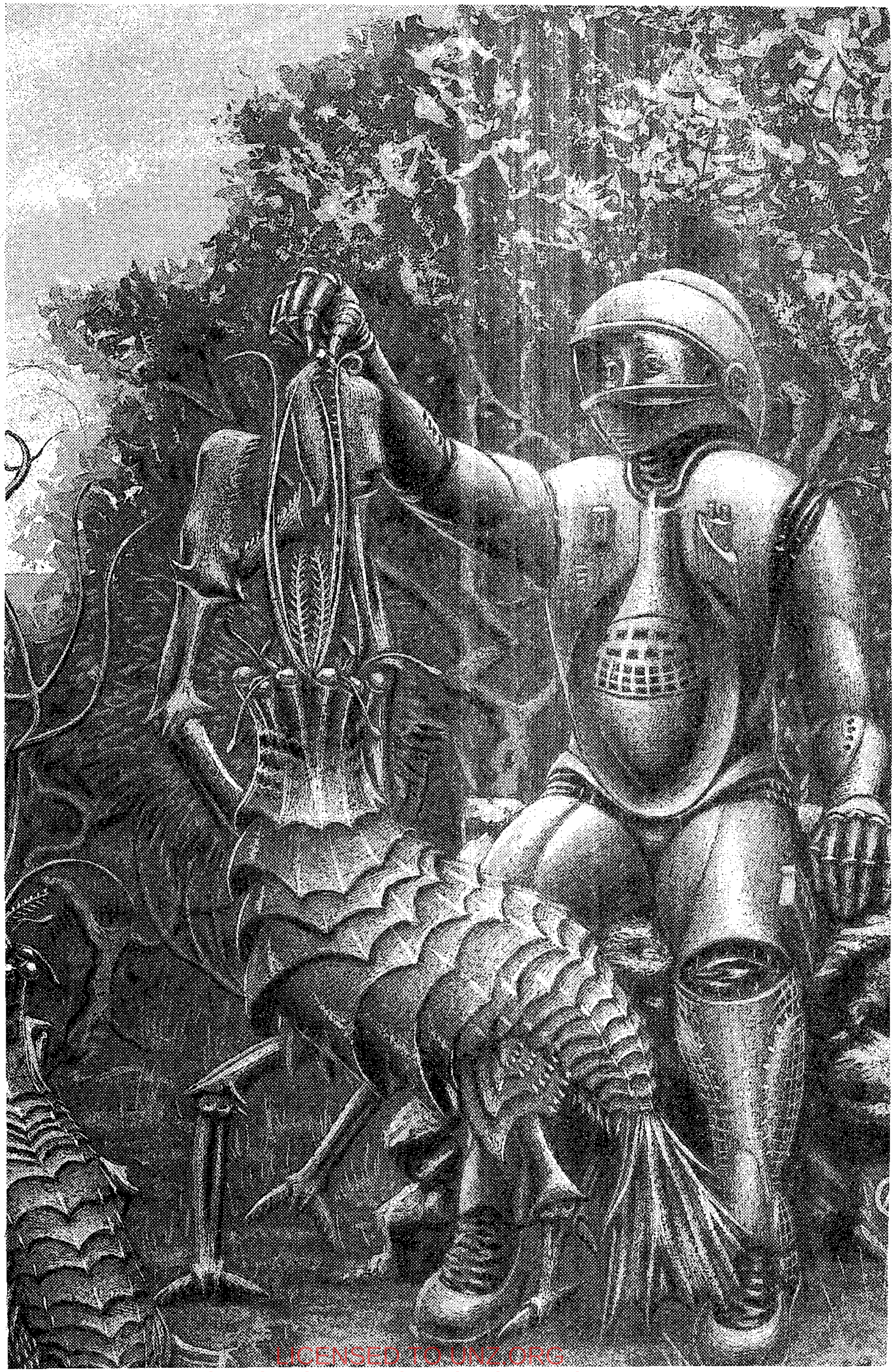
Bud Sparhawk

RESURRECTION

A conscientious man must always try to do the right thing. The hard part is knowing what that is, especially in an alien world. . . .

Illustration by Alan M. Clark





“N*on posso. . . ,*” the lobster-like alien beside me whispered in perfect Italian as we pushed our way through the marshy vegetation, a forest on this excessively wet and gloomy world. I could not continue onward either.

*“Sì, signore Ttch*lok,”* I responded in the same tongue, nearly choking on the liquid glide in the middle of his name. In response to his request I looked for some place of refuge below the thick canopy. Some place where we could safely hide.

Ttch*lok was my first and only convert on this ungodly miserable planet. Six months it had taken for me to find one of these semi-intelligent, hard-shelled beings who had responded to the Word and I was not about to lose him.

I was not worried for myself, for whatever punishment my shipmates could bestow on me would be insignificant in comparison to what my convert would suffer. My friend would be entirely consumed if we were discovered.

I could not let him be eaten by those cannibals.

I

Our mother ship's initial pass around the planet had revealed no cities, no centers of habitation, nor any of the other usual signs of civilization. To every inquiring sense the planet appeared Earth-like, as these distant places go, and therefore a ripe candidate for exploitation—another victim in humanity's insatiable cry for living space.

Ten of us were deposited on the planet to verify these preliminary findings and discover more about the life that filled this place that was so distant from Earth.

After our team had been dropped from orbit, our mother ship departed to examine the next system's prospects. It would be two years before she returned. In that brief time our team had to assess this planet's treasures and dangers. We had to ensure that she was ripe for settlement.

I was the team's botanist. Since botany is not a field that can keep one productively employed during the long silences between the stars, I had spent much of my copious spare time assisting the ship's chaplains.

The Jesuits on Earth had trained me to be one of their own, so I was familiar with all forms of religion around the world and off it.

The botany and biology courses I had taken as an avocation, discovering a facility with the subject that led to no little expertise and, eventually, to a role as professor. When I began my ministry I little suspected that teaching would be a way of supplementing the pittance that supported my woefully small congregation, a post I had abandoned when I secured a post on *Hercules*'s outward voyage of discovery.

I helped the ship's chaplains as they attended to the ships' weak religious needs. This took no great art on my part, for most of the crew were of lukewarm faith. They followed the religious rituals while their minds were, no doubt, preoccupied with temporal thoughts. Form, not substance, was the watchword.

On different days and occasions I assisted the priests, rabbis, mullahs, lamas, brahmins, and the lone archimandrite. Each chaplain praised me for my faithful rendition of their rites, sometimes remarking on some fine point of ritualistic precision and faithfulness where I had done well. There were no complaints.

Yet I wondered if any of these religious people sensed the black hole in my soul; the absence of that core of faith that was the center of the religious experience. I was a sham. Yet, helping them and observing the rituals helped to pass the time.

It made me feel useful.

Our survey party had selected a dry peninsula within the temperate region for our base camp. We'd had to build pads under the ship to keep it from sinking into the soft, moist soil.

Our chosen site was surrounded with low-growing plant life. I immediately noted that some of the brush appeared littoral in aspect, as if it had evolved from living ever on the barrier between dry and wet. What periodic flooding could give rise to this characteristic was something I promised to research when I had time. All evidence suggested that the nearby placid sea was not always at its current level.

Hidden among the alien plants was an amazing collection of animate life. Every ecological niche seemed so loaded with competing species that scarcely a square meter of the terrain lacked its own teeming population of flora and fauna.

The curious thing about most of the motile life was its dependence upon armor. The most extravagant array of plate, shell, horn, and scale was employed by every animalcule or insectoid to protect all their vulnerable parts.The local life had no reluctance to try to see if we were as edible as their local prey. To protect ourselves against their sharp array of pincers, claws, teeth, and proboscises we erected a dome about the ship and carefully sterilized every square centimeter within it to create a cordon sanitaire. In this limited area we could squish about in relative security. Walking unencumbered on the muddy soils inside the dome was a welcome relief after spending a week cramped either two to the bunk in our small lander or encased in our hard suits when outside.

Only after we were certain that our dome was secure against the sharp biting, cutting, and tearing appendages of the local pests did we set up our instruments and begin to work in earnest.

I remarked upon the excess of the indigenous life's protective strategies on one of our first outings as I snipped leaves and stems from some promising specimens of *X-Gramen secundus*, following the conventional genera naming with the necessary "X," for eXtraterrestrial.

"The Earth had a similar proliferation of armor during the late Cambrian period," Ed replied as he gleefully swept the nearby brush with a vacuum pump and gathered a collection jar full of angry specimens. "Shows the principle of parallel evolution—similar problems lead to similar solutions."

"But why didn't that persist?" Elsbeth asked as she scooped dollops of lime-green mud into her own sample tray.

Ed chuckled. "Ought to study your biology instead of geology. Most of Earth's armored forms disappeared in the first Great Extinction, the one long before the dinosaurs arose. We only know about them because of the evidence in Earth's fossil record, and the horseshoe crab—one of the last survivors. If it wasn't for that extinction, all of Earth's creatures would probably be wearing a natural coat of armor instead of soft and"—he added with a grinning leer at Elsbeth—"their sometimes very appealing skins." Elsbeth blushed and quickly glanced away. I wondered at her reaction; everyone knew about the two of them.

The lobster-like creatures started showing up a few days after we completed the dome. We dubbed them lobsters only because of their huge strength claws and the array of feelers, eyes, and other sensory apparatuses projecting from the front end of their long bodies.

There the resemblance to Earth's lobsters ended. The aliens' bodies more closely resembled an armor-plated dog, who just happened to have six legs and a wide, flat tail. The front end of the creatures rose above the rest of the body and provided the perch for a cluster of sensory organs that stuck out in all directions.

The largest of the first group was hardly a meter high and weighed under ten kilos, according to Ed's careful measurements. The smallest was half that size.

Despite their frightening appearance, they did not appear to be menacing, or even express an interest in us as a possible food source. Instead they followed us everywhere, like curious monkeys encountering explorers for the first time. Ed Corson, head of the biology crew, modestly bestowed the onerous name of *X- Crustacea Decopeda Homarus corsonni* upon them, adapting our initial nickname and appending his own. We simply called them homaroids, for they rapidly became a pain in the you-know-where.

Within a matter of days there was a considerable crowd of the homaroids pressed hard against the unyielding surface of the dome. They appeared to be observing us as we moved around the dome, hard at work at our tasks, ululating the whole while in their gurgling, fluid voices. We set Ajita, the closest thing we had to a psychologist, to studying their actions.

On my second trip outside, one of the homaroids proceeded ahead of me, snipping samples exactly as I had done the previous day. To my wondering eyes it began laying them on the ground: root, leaf, stem, fruit, pod, or flower intact—the perfect specimen presentation each time. Just as I had done.

Curious at its seeming ability to so faithfully mimic my actions, I made sure that it watched me carefully uproot an entire plant. I wanted to see what parasites or symbiotes might be attached and was curious as to what my companion would make of this. The homaroid watched me carefully.

After I dug up two more plants, taking care not to vary my actions, the homaroid began to do likewise with another plant nearby, carefully trimming the loose soil away with that huge claw, much as I had done with my spade.

Ajita became very excited when I told her what had happened and immediately set up a testing program. She started running a few specimens through mazes and quickly graduated them to more complex tests when they showed increasing levels of sophistication with the test protocols. Her small collection of homaroids were seemingly able to learn in instants and retain it long term—or so she believed. The difficulty she faced was that her subjects tended to die just as she thought they were making headway.

"Their bodies decay rapidly in this heat," she told me. "They start to smell, the shells fall off, and the bugs start eating them right away. I watched a swarm clean out the entire shell in a matter of hours after the subject died. It was horrible to watch."

Death was only one of the problems with the homaroids. Many of the other lobsters tended to suddenly disappear. We suspected that the larger homaroids that had started arriving were responsible for these disappearances since, by that time we had become aware of their cannibalistic practices—preying upon their own kind.

These late arrivals were much the same in appearance as the earlier ones, but had different shell markings and were a quarter size larger. Ed playfully and provisionally named these *X-Homarus evenlarger,* asserting them to be another variant.

None of the smaller homaroids ventured close to the larger ones, apparently anxious to avoid coming in reach of their claws. As a result, each *evenlarger* was surrounded by an open area. When they moved, the smaller ones parted to each side as waves in a chitinous sea.

Ajita reported that the larger ones tested as more intelligent than the others. Ed borrowed a few for closer examination, ruining Ajita's carefully planned testing regime.

Ed dissected his captives with great care and confirmed his earlier suppositions—the organ that the homaroids used as a brain was not localized, like ours, but was an evenly distributed extension of their central notochord. This latter structure, what we would term a spine, lacked our familiar surrounding bony structure. A little reflection revealed that they had little need for such protection since their entire body was encased within a hard exoskeleton and needed no extra protection.

The notochord ran the length their body, with sites of the higher functions located more toward the center, close to the cluster of sensory organs that projected from the top, while the motor functions lay nearest the extremities. It was a most efficient design.

What was significant was that the

"brains" of the larger species were significantly more complex than their smaller cousins.

Ed's heated arguments with Ajita about the impact of this discovery on the possible intelligence of the homaroids led to an amazing discovery: that the homaroids were able to grow additional brain mass, which provided growing room for additional dendritic nerves, the connectors between active sites.

Both the homaroids' increase in mass and accompanying dendritic growth appeared to occur in response to learning pressures, as Ed and Ajita learned through ruthless experimentation and dissection.

Ed explained the meaning of this to the rest of us during one of our periodic review sessions. "The same sort of growth of dendritic nerves occurs in humans of all ages whenever they learn new tasks, but not at the rate of growth we've found here."

"But humans just expand the number of dendrites in their brains, not expand the brain itself," Ajita corrected.

Ed considered, "Well, yes. But we have a lot of excess room in our brains. I also think our dendritic density is higher because of the differences in cell size. I found that the cells of most of the homaroids are on a grosser level than ours—ten to twenty times larger. You can even see some of the larger cells with your naked eye. This means that they have to increase volume to compensate for the lower density."

Al waved his hands, as if trying to diagram the problem he saw in the air. "It scares me when you contend that they can grow the equivalent of a second brain. Where will it stop? If their environment puts enough pressure on them won't they eventually become intelligent? Maybe even to the point of sapience!"

The remark sent a challenging and exciting thought through me. I wondered if they would develop a soul along with their intelligence, since they would necessarily understand guilt and consequences.

"I doubt that could happen," Ed said, dismissing Al's idea with a wave of his hand. "Unless they are more like Earth's crustaceans than evidence seems to indicate, the inflexible exoskeleton that protects them prevents any great amount of expansion. Once a homaroid grows enough to fill its body cavity it can't expand any more. That's a natural limit."

"And if it can't grow then it can't learn beyond a certain point," Ajita responded on cue. So much for my dreams of an alien dialogue.

Or the existence of their souls.

As time went on even bigger members of the homaroids began gathering around the dome. Ed assured everyone that these were simply variants of the originals whose difference in size was the result of environmental conditions. He further stated that the bigger ones probably lived farther away, where a more plentiful supply of food was readily available. We all debated continually about the evolutionary mechanisms that would allow such variations in dimensions.

Perhaps, some of our crew concluded, it had taken these later arrivals longer to reach us from their distant feeding grounds.

So it seemed to me as well.

Eventually we had a broad range of homaroid sizes outside the dome. The crowd ranged from the original one-meter *X-Homarus corsonni* to the *X-Homarus evenlarger,* some of whom equaled the mass of a small human.

Not a few of the largest ones had imprinted on specific members of our crew. Even Ed, the chief homaroid dissector had his claque of devoted followers as he went about his grisly business. Often he had to shove them away to prevent them from reaching out to grab a snack from the exposed meat.

"Damn homaroids are omnivores," he remarked proudly. "True survivors. Just as soon eat their own flesh as anything else."

I despaired for the existence of any semblance of a soul in such animals.

The homaroids followed us every time we ventured from the dome. Since each had striations on its carapace, with unique variations in color and form, we found that we could easily identify individuals. A few of us even gave certain ones endearing names, much as you would a pet.

My own followers were headed by Julius, a medium-sized *evenlarger* with worn green and brown markings, and a dozen or so smaller *corsonni* of assorted sizes. I myself noted further correlations between intelligence and size as they mimicked my actions. Ajita had been right, the bigger ones were definitely quicker to learn new things and could handle complex tasks with ease.

On each new plant I discovered I bestowed a provisional Latinate name, for I fancied myself as an alien Linnaeus come to classify and order their world. To amuse myself I began to speak in my native Italian, conversing endlessly about my activities to my alien audience while I gathered my samples.

I often mused, as they repeated the liquid phrases of Italian that I had taught them, just how well they would learn the beautiful language of Dante Alighieri. It should not be difficult, given the fluid nature of their vocal apparatus. Were they as primitive natives of Italia, to observe our alien selves much as his fictional protagonist had observed the demons and devils?

At a deeper level I wondered if we could stay humanity's colonization to permit these creatures to one day evolve their own version of a political Rome, an artistic Venice, or a Florence brimming with intellectual ferment? I tried to imagine tables full of homaroids sitting on some damp Via di Vita, sipping espresso, and discoursing on the state of the government, perhaps even discussing philosophy . . . and failed. Creatures without a soul cannot aspire to civilization.

An *evenlarger* joined my group a week or two after Julius had suddenly disappeared. *"Mi chiamo Jbl*kuh,"* he said to me with a surprisingly flawless Italian accent, rapping himself on his shell with his claw by way of greeting one morning a few days after his first appearance.

Perhaps it was merely because I had been speaking that tongue so much lately that my new companion had picked up the Italian, surpassing even the more senior ones of the troop in his facility with the tongue. It showed surprisingly good mimicking abilities, much as the original had done with my actions regarding the plant.

"It's just natural mimicry," Ajita remarked when I related this to her. "It simply copies what you do and say. Don't read too much into it."

Still I wondered at the similarity of his name to that of my former follower; had I been using that form of address on him by habit? I dubbed him Julius II and he quickly became the new leader of my flock.

"Nuovo! Nuovo!" Jhl*kuh said one morning as I exited the dome with my sample kit, ready for another day of searching and classification.

"A new plant?" I'd replied in surprise. The initiative, intelligence, and memory displayed by his remark was quite startling. It indicated that these *evenlarger* might not be so lacking in intelligence as Ajita supposed. Perhaps we should bestow on them the as yet unclaimed *X-Homerus sapiens* designation.

"Dove. . . ," I began in Italian and then switched to the hideously harsh vulgar tongue that was our lingua franca, knowing that it could not comprehend either way. "Well, let us see it," I barked slowly. Into the brush we plunged, with the rest of my claque behind us. I wondered what the day would bring as I trudged along behind Jhl*kuh in my hard suit.

Our troop's trek to the center of the broad peninsula from the dome took most of the morning and, at the end of it, I discovered not one, but a dozen new specimens. These appeared to be a new order, one closer to the seaweeds of tropical seas than the land based ones I had seen so far. I named them *X-Aquaia fortejulii,* in honor of my new guide. The plants' presence this far from the water was an indication that the sea had only recently receded, in geological terms, and that their recognizably acquatic features were residual attributes.

Again I considered writing a paper on the possible evolution of these plants and then reconsidered: better, more learned scientists than I would theorize and develop a history of this planet. My present role was merely to catalog the items for an initial survey, not try to unravel the story of this planet's evolutionary history.

I even doubted that the provisional names I gave to this plant would withstand the erosion of time. This I took as further evidence of the transience of man's activities and of my own in particular.

By the end of the fifth month Ed finally found out how the homaroids got around their growth limitations and why there was such a variation in their size. He informed us of his findings over our simple evening meal of bread and cheese, smiling broadly as if he were the proverbial cat that caught the mouse.

"They *do* grow very much like the crustaceans of our mother planet," he explained patiently. "As we know, periodically their growth reaches the limits of the volume inside of their exoskeleton."

"Yes, and that was why you and Ajita said they couldn't be too smart," Al remarked with a worried frown, as if he still feared that our pets would suddenly become sapient and declare us *persona non grata* on their planet.

Ed frowned, as if he had been caught in a lie. "Well, yes. I did. But that was only a preliminary thought—a theory—nothing more. Now I have rather more convincing evidence to the contrary." He took a sip of tea and then continued.

"As I was saying, rather than stop at the point where they reach the limits of their shells, these creatures seem to be able to grow a new exoskeleton with more room to replace the constricting old one."

"Wait a minute," Ch'ou, our atmospheric specialist said, interrupting Ed. "Don't you have that backwards? Shouldn't it be that they shed and then grow a new shell? It isn't reasonable that you could get a larger shell inside a smaller one. That's just a mite impossible."

Ed smiled as if he had anticipated the question. "Not impossible if you understand the process. The new chitinous shell is soft and pliable and somewhat compressed; all folded underneath the exoskeleton. It is only when the old shell is shucked and it becomes exposed that the new chitin expands and hardens to become a solid exoskeleton. Crabs on Earth do this every year."

I thought of what he said and wondered out loud, "How long does it take for the new shell to harden? Wouldn't that make them vulnerable? I mean, during the period they are without armor they must be quite defenseless against all of the bugs and things that prey on them."

"Quite right," he snapped back instantly. "I expect that it would take three to four days for the chitin to harden to the point where it would be effective as armor."

"Now wait a minute. If their shell is so soft then how could they move? And no, I don't mean the obvious," Elsbeth said smartly as Ch'ou started to interrupt her. "Ed told us earlier that the homaroids' muscles are anchored to their shell. How do they prevent their muscles from tearing the soft shell apart when they rid themselves of the old?"

Ed explained, "The dormant one I dissected seemed to be in a hibernation state. I guess some internal process paralyzes their muscles during the period it takes for the hardening to complete. I would suppose that they sleep through the process as well."

"Oh my God," Ajita shrieked. "My specimens weren't dead! They were just shedding their shells!" With that she raced outside, no doubt to throw some protective coverings over the pens to prevent further losses.

"I still don't understand how they protect themselves during this vulnerable period," I said aloud. "And another thing; why don't we recognize the newly sloughed, or vice versa?"

Ed smiled. "Oh, we don't? What about that Julius one that dotes on you?"

Wait a minute! I rocked back on my heels with the dawning realization of what he had just said. Julius must have been the reincarnation of my former follower. The revelation must have shown on my face.

"Exactly," said Ed, smiling broadly.

II

The ship carrying a delegation of civilized homaroids arrived on the 250th day following our landing.

In many ways the ship had parallels to the Roman triremes, with the high poop and armored prow. But instead of banks of oars lining the side, dozens of small creatures were securely lashed to the sideboards, their tails trailing in the water and providing the means of propulsion. A length of cord led from each creature's single feeler back to the helmsman. Apparently steering was accomplished by tugging on the traces, much as our ancestors must have guided the horses of antiquity.

The ship grounded and three immense homaroids stepped onto the shore. Showing no evidence of fear they came slowly and deliberately toward our camp.

We had tumbled out of the dome only minutes before. As soon as the ship had been spotted we had begun to throw on our hard suits, anxious to examine this startling and unforeseen event at closer range. The aliens, it seemed, were taking the initiative we should have begun. This was akin to the Native Americans canoeing to Spain to meet Isabella.

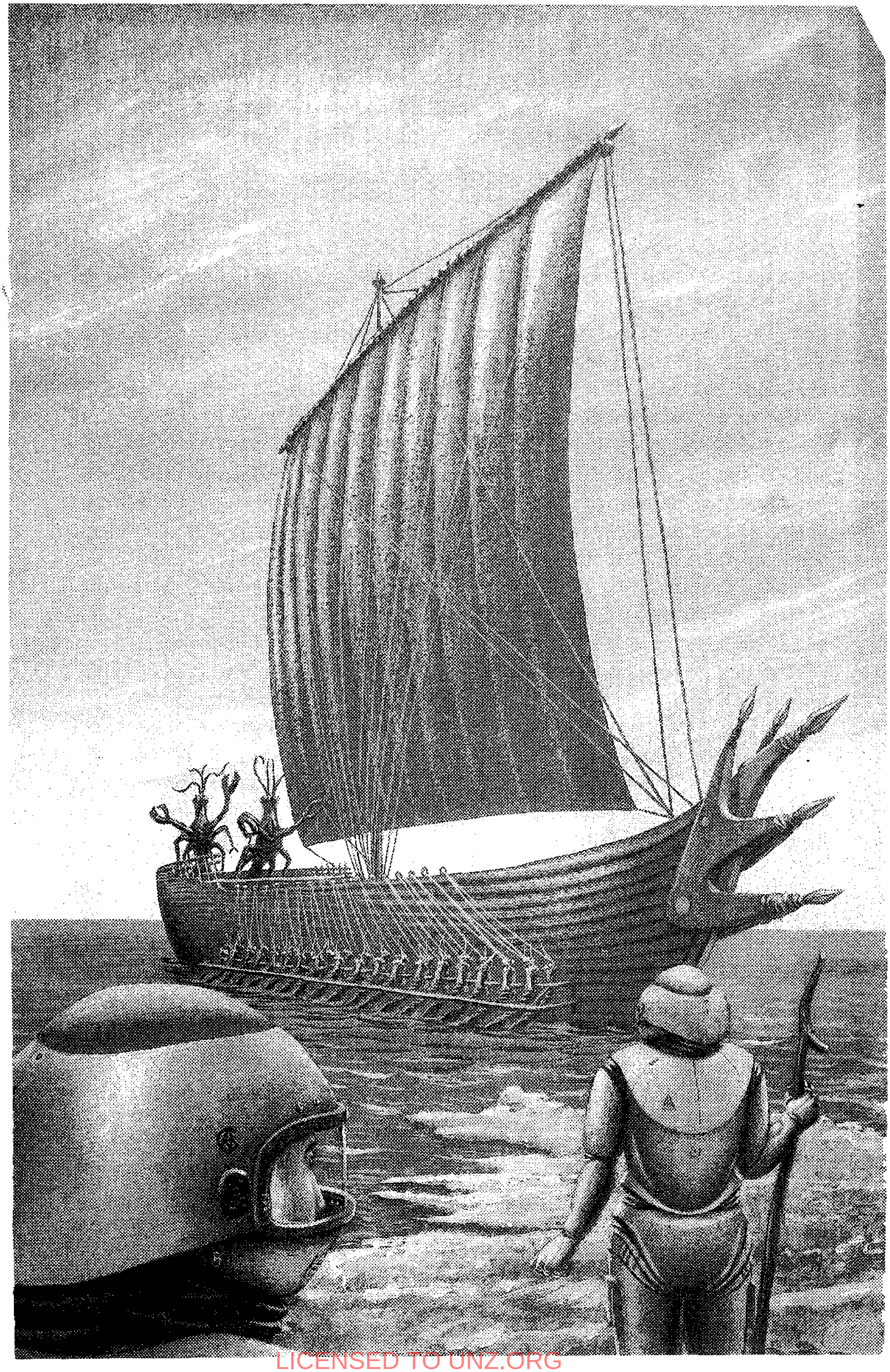
As I poured myself into my own suit I wondered at the origins of these arrivals. How could there be civilized creatures on this planet? We had discovered no recognizable cities yet they had an advanced technology sufficient to build sea-going ships. How had we made such a serious mistake? More importantly, what meaning should we read into this turn of events?

We congregated six paces from the dome's entrance and stared at the new arrivals. As soon as they neared the dome they stopped, as if awaiting our response. It was a tableau of opposing monstrosities, although who were the monsters depended upon your point of view, I supposed.

These creatures were quite different from those we had become so familiar with over the past months. All three were nearly two meters tall and each probably massed at a hundred kilograms, if not more. All were painted with stripes of brilliant hues and carried pouches over their backs. The one with the orange and black stripes down his side carried a long staff, adorned at the top with a golden sphere. A badge of office, I guess.

A smaller, unpainted homaroid, of a size and appearance equal to my Julius, trailed behind the trio at the end of a tether. The other end of the tether was held by an alien adorned with vivid green stripes.

With a quick tug of the tether the smaller homaroid was brought to the fore and was pushed into the space between the threesome and our band of hard-suited explorers. The alien with the orange and black stripes raised the staff in his strength claw and drove it into the ground with such force that it penetrated the soil to half of its length. A few turns of the tether about the stake and the smaller lobster was anchored in place. With



that accomplished the three newcomers returned to their ship with not a glance behind them.

"Well, what do we do now?" Ed asked. "Is this one a gift?"

"Seems a healthy specimen. The shell looks new, as if he recently sloughed," Ajita said as she approached the captive creature. "Don't worry, I won't harm you," she said gently as she raised one hand toward the captive, as if she expected it to understand her.

The lobster immediately began burbling and babbling a string of flowing sounds, the like of which we had not heard before. When we did not respond the creature again repeated what appeared to be an identical stream of sound.

"Oh, my heaven," Ajita, who had a better ear than most of us, remarked. "Could that be language we are hearing?"

Language it was, as we quickly discovered. Not surprisingly, these ship builders had the complex language so necessary for their civilization.

Ed promptly pronounced that these newcomers were the *X-Homarus sapiens* we had discussed. It seemed appropriate at the time. We all agreed with his decision.

Over the next week each of us took turns trying to teach the small captive the rudiments of our language and trying, without much success, to make sense of its own. Al rigged up a box that would reproduce those fluid, gurgling sounds that we could not imitate. That solved the audio problem for we could now approximate the sounds the captive made with some fidelity.

The grammar and structure became a major obstacle. From all we could reason out both verbs and nouns of the homaroids' language were highly irregular. But how these were ordered was more than we could understand. There should have been a linguist in the party, but without evidence of civilization why should we have bothered?

The structure seemed aggregative, complex parts of speech being built up from smaller packets of sound, each of which probably represented a word or concept—we couldn't tell which. Somehow a part of understanding their "tongue" must have been partially hard-wired, just as was our own.

We despaired of ever decoding it and, since I had such success in teaching Julius Italian, we began to use that tongue to speak to the tethered captive.

To its credit, and our embarrassment, the creature learned more quickly than we. As it did so I was assigned to spend more time with it, teaching Italian to a willing student.

Meanwhile Ed and Ajita had discovered another disturbing fact about the homaroids' growth pattern. It appeared that the process of sloughing expended considerable energy, energy that came from the consumption of their own flesh—about half of the body weight was lost, much of it the precious brain cells. Memory, of course, went with that. Each homaroid awoke from the sloughing as a new creature, possessing only a fraction of its former memories.

"Twenty percent memory retention, at most," Ajita remarked with some sadness. "What a loss of knowledge for them. What a loss," she remarked with considerable feeling, looking toward the envoys' ship.

The blockbuster discovery came a few days later. Ed had noticed that the homaroids that snacked on the guests at his dissection table appeared to gain some of the victim's knowledge. He had Ajita test this with the smaller versions that she used to run the mazes.

"There seems to be a mechanism very much like we once thought some *Planaria* had," Ed explained. "They incorporate the chemical from the brain cells directly into their own, without the interference of a destructive digestive process. It must be an evolutionary mechanism: the ones who survive the shedding must compensate for their loss of knowledge by consuming others. The better predators must gain the most, become more skilled and therefore survive the longest. Makes a great deal of sense."

At first we thought the animals used to propel the boat were of another species which bore only superficial resemblance to our friendly homaroids, that is until I ventured close enough to examine them. With a sense of shock I realized that not only were they of the same species but each creature's sensory apparatus had been cruelly amputated, leaving them blind to all but a rope tied to their one remaining feeler.

How could their masters be so cruel as to do this to their brothers? I wondered. Had they no pity, no empathy for the pain and suffering of their captives? What sort of civilization would allow such barbarities?

Then I recalled with shame the Roman slaves who had been chained to their oars in the Roman triremes: Was there a moral difference between us?

I noted that one of the "slaves" was slumped in his halter, as if he were extremely limber. The crew must have noticed this as well and were soon untying it from the thwarts and hauling it on board. Curious to see what would happen next I placed one foot on the prow and raised my head above deck level.

The sight was not one I expected to see and, frankly, horrified me.

The three emissaries and the crew were tearing at the poor slave, ripping off patches of his shell, pinching off gobbets of the white flesh inside, and stuffing them into their maws. These creatures we had thought to be civilized were no more than cannibals!

Quickly I backed away from the ship and raced to the dome, anxious to tell the others about these barbarians and their hideous practices.

Ed remarked matter-of-factly when I related what I had seen. "I can think of some earthly analogues even though such behavior by an intelligent species intrigues me. We already knew that the homaroids were omnivores so it shouldn't be any surprise that these feast on their kin as readily as anything."

"But they are intelligent and civilized," I shot back. "We humans certainly don't do that sort of thing."

"Maybe we don't do it now, but I'm not sure whether that is a social artifact or some more basic survival mechanism at play," Ed replied. "Besides, humans have had lots of alternative sources of protein throughout our history. From what we know of this planet, the easy-to-find sources might be limited to the homaroid family. I guess feeding on their galley slaves is natural to them. Hey, didn't our ancestors eat their pack horses when they ran out of other sources of meat?" He laughed at my expression of dismay.

How could he equate eating dumb animals with consuming your own kind? The brutality of creatures who preyed upon their own horrified me. I could not consider them civilized if they followed such practices, no matter what the state of their technology.

And I despaired for their souls, for surely they possessed sufficient intelligence to understand their guilt.

At the end of each day one of the emissaries would approach our language student with a pail of scraps and speak to it for a few moments as it ate its meal. Afterwards, the emissary would take the empty pail and return to the ship.

I made it a practice to speak with the captive immediately after these visits, hoping to glean some information of substance about the intentions of our visitors and to probe the depths of the creature's understanding of its own environment.

Ttch*lok, the captive's own name, I learned, proved quite willing to converse with me, as anxious to learn about our ways as we of theirs. Ttch*lok told me a few things about his place in their society.

For one thing I learned that he was not a member of the ship's crew but was merely a tool—a translating animal that had been trained for one and only one purpose.

"And what," I asked, "is your destiny when that purpose is fulfilled? Will you then be permitted to be a citizen and recognized as an individual?"

Ttch*lok seemed horrified at my question. "Animals have no destiny," he responded calmly, without a trace of fatalism. "I will die when my work is done."

I wondered at his answer the rest of that day. Isn't it reasonable that when a being achieves enough intelligence to understand its own death then it can also understand the concept of its own immortal soul?

I decided to discover the truth.

"We have been traveling for three crews," the emissaries explained once Ttch*lok had mastered the rudiments of Italian enough to act as translator. Three crews would be nearly one hundred individual deaths. I shuddered at the thought of so many sacrificed merely to propel this ship to us and the casual way they used these losses to measure their voyage.

They'd started our way soon after hearing of our landing from their scouts, within a month of the arrival at least. "Quick reaction," Al said in a worried aside.

"The Great Ones send their greetings to you," the gold and black one continued. "They wish to know more of you and your ways. We few are their representatives and have been sent to grow in knowledge."

The Great Ones, we learned through painful dialogue rife with misunderstandings on both sides, were apparently a group of ancient homaroids who had managed to survive long enough to amass great intellect and a large storehouse of knowledge. If only 20 percent was retained with each of their sheddings I wondered at the precious cultural knowledge that must be lost whenever they shed.

These intellectuals were, of necessity, highly reclusive. This characteristic would limit the amount of new things they would be exposed to, and reduce the need for frequent sloughing that would result from additional knowledge.

Another probable reason for their secretive ways was, I suspected, to protect themselves from becoming a feast of knowledge for some ambitious competitor.

The horrid prospect of knowing that others could gain a portion of your hard-won knowledge by eating your flesh as you slumbered awakened every horror story of wraiths and vampires that I had ever heard. How pitiable and constricted their lives, I thought, to always live in fear of those around you, afraid to challenge your mind or grow in knowledge because it would make you even more vulnerable. The thoughts of homaroid intellectuals gathering on the Via di Vita to discuss philosophy vanished like soap bubbles in the sunlight.

Because of their intellect the Great Ones also commanded vast resources and a coterie of lesser beings who provided protection and brought information to them. It would be the envoys' purpose, I suddenly realized, to reduce this journey and knowledge of ourselves to digestible portions for their masters. I shuddered at the thought.

After a short debate when learning of our arrival, the Great Ones decided that contacting these strangers who had appeared on their world was worth the cost of growth.

Their ship had been dispatched within the week.

We watched with some curiosity as the crew of the ship rounded up a few of the smaller *corsonni* and herded them into a pen they had erected beside their trireme. We suspected that these would most probably become the replacements for their slaves.

The other units had been unleashed from the ship and tossed into the enclosure with the new victims. Whether as trainers for the others or as a food supply I could not imagine. Time would tell, I supposed with some sorrow, and said a blessing for their souls.

Each of the young homaroids had a line tied to one of their feelers and was led into the water. The crew would tug on the line as soon as the tail started to wiggle. Another tug and the other crew member would grab the tail to hold it still. This went on day after day, fifteen minutes per individual.

The mutilated ones meantime were searching the pen, learning their way about with their one feeler until they knew the boundaries of their enclosure. In time each began seeking a quiet place of refuge, usually one of the corners, to begin the process of softening and renewal.

I watched with gorge rising as each was quickly eaten by the others no sooner than the shell had softened.

"Fascinating adaptation," Ed remarked as he leaned forward to observe the process better. "Not only are the originals a good source of food, but the ones eating them also gain some of the training as they eat, which makes their own training go faster. I would wager that the crew doubles the speed of teaching the new ones this way."

"But why do they leave the new ones alone otherwise? They have not mutilated their sensory apparatus as yet."

" 'Edited' is the word to use, padre. And to answer your question—No, they probably won't edit them until they're the right size. I would guess that they do that during the hibernation of the softening so that the newly awakened ones know only the reins." Ed thought for a moment, scratching his chin absently. "Pretty clever, eh?"

Clever? I could think of other words to be used; words such as barbaric, gruesome, despicable, odious, atrocious, and unthinkable! Not to mention predatory and abominable. Yet none of these could adequately define the depth of the emotional reaction that I had for these hateful creatures and their vile practices.

III

Our sessions with the envoys had given us some insight into the workings of their society. They had no great aggregations that could be termed cities, for why should creatures who are so vulnerable choose to live close to their potential predators? Instead, each one who grew to adulthood built a secretive cave whose entrance was carefully hidden. Here they could shed their shells in security when the time came. Here they could hide from those who would use them.

With some shock I discovered that none of the envoys knew of their parentage. Sex for them was a spurt of eggs or semen in the springtime response to the tides. They had no emotional attachment to the free-swimming young homaroids that they used so abominably. Only those young who had achieved an educatable size and proven intelligence were brought into servitude.

It was likely then that these civilized beings preyed equally upon their own genetic heirs as well as others, using them as beasts and as food. It was Bentham's worst nightmare come to life.

I also discovered that they had no concept of religion, no spiritual center to their life. My dialogue with Ttch*lok each evening became a ritual that followed his feeding. But now there was a purpose in my discussions, for, through him, I believed that I could regain the faith that I had lost. If I could have God speak to this creature then there was still grace in the Universe. And there was still hope for me.

I began to tell Ttch*lok of a spirituality through which he could hope to surmount the tether that bound him. I spoke of the virtues of a faultless life, and the certain rewards of the afterlife after the release of his soul. I spoke of a kind God and how he would reward those whose life was free from sin.

In time I believed that Ttch*lok began to comprehend and understand the possibility of his own salvation. I baptized him one night with a cupful of water from the nearby sea, as seemed appropriate at that time and place. "My friend," I made him repeat in Italian as I held his claw and arm upraised, "We are reborn."

We prayed together, there on the damp, green mud; a strange crustacean and a failed priest, repeating words whose origins were centuries old and hundreds of light-years distant.

I rejoiced in my eager convert, imagining that he would carry religion back to the godless civilization that spawned him. I fantasized that Ttch*lok would be my first missionary; that he would carry the message of redemption and spirituality to the needful and unknowing souls of this horrid world.

I would have a flock of believers at last! Strange though they might appear to others of my faith. I relished the souls that were to be saved.

One evening I noted that the pail seemed rather full to overflowing. Choice scraps were evident. "Was this a reward?" I asked innocently for today's session had gone extremely well, with hardly an error in understanding.

"No," Ttch*lok responded with no hint of sadness. "They are feeding me to make sure that I am full when my time comes."

"I don't understand. What time is this? Are you going to return to your masters?" The emissaries had mentioned nothing of their departure.

Ttch*lok clicked his feelers together nervously. "I am at my limit, father. I have learned so much that I feel that I will burst if relief does not come soon."

Startled at his remark I peered closer. Yes, the signs were unmistakable; there was a cloudy appearance in the eyes, the shell had taken on a milky sheen, and the movement of all appendages were languorous and weak. "The softening is coming," I said in sudden understanding.

"Yes," Ttch*lok replied. "And they will eat me for my knowledge when that happens."

I was rocked back on my heels. Eat their translator? Why would they. . . . Then it dawned on me: By eating him they would gain facility with our language. With that core of knowledge they could more easily gain fluency. Yes, and then they would no longer have to suffer the laborious and demeaning process of translation through a captive animal.

It made perfectly good sense. Ed would no doubt think it a "clever ploy."

I thought that it was horrible.

All through the night I tossed and

fidgeted in my bunk, wondering what my moral obligation was in this case. On the one hand the feeding of Ttch*lok to the three emissaries would materially enhance our process of learning more about their civilization and this world. I had a sworn obligation to aid and support that process.

On the other hand, if I did nothing I would lose my single convert. I would allow a Christian to be sacrificed on the altar of expediency. Not only that, but a living, thinking, feeling being of no little intelligence would be consumed as fodder, with little ceremony or remorse on the part of his masters. To them he was simply a convenient animal whose substance could be harvested with dispatch.

Did I not have a higher obligation to save his soul, if not his material being? I had baptized this child and therefore had a debt to protect him.

The conflict of the two obligations wore on me through the long night hours.

In the steamy dawn I crept from the dome to where Ttch*lok lay sleeping. "Quiet," I whispered as I cut the tether that bound him to the staff. The line was surprisingly weak. Ttch*lok could have sundered it in a moment with his claw, had he so chosen.

"Come with me, my friend," I said and led him away from the dome and into the dark vegetation surrounding the campsite. He resisted weakly at first, as if unwilling to move. I assumed he was early in the stage of stupor that preceded the softening.

Finally he stirred, albeit slowly. I had momentarily feared that the progression of the softening had already reached the point where he was unable to move. That would be a serious problem since I doubted that I could bear his weight in addition to the hard suit.

For hours we trudged through the dark foliage and sucking mud, ever away from the dome and those who would misuse Ttch*lok. When gray dawn lay upon the sky we were kilometers away, heading up the peninsula toward the swamps of the mainland.

Ttch*lok stumbled frequently as if his limbs were not strong enough to maintain the pace. I gave him such help as I could, supporting his weight whenever it seemed he was losing strength.

The signs of his forthcoming change were more apparent in the morning light. A small crack had formed, extending from the base of his tail to a point halfway along his back. It had not yet separated, for I could see no white flesh between the sides of the crack.

I prayed that there was still enough time for us to find a safe place to hide.

"*Non posso continuare.* I tire," he said finally and slumped to the ground. He could go no farther and, I must admit, my own resolve to continue had faded in the reality of the forced march and my inability to drag his weight any longer.

I discovered a sheltered spot. It was a simple overhang of dirt on the side of a ridge covered with feathery shrubs. I dragged him in as far as I could and lay beside him, exhausted.

We could not be spotted from the outside, I was certain of that.

"Is there anything that I can do?" I asked, wondering what needs Ttch*lok might have and if I were capable of providing whatever might be requested.

"You should not have taken me," he whispered so softly that I strained to hear him. "I was not made to live beyond my purpose."

"Nonsense," I responded at once. "No one deserves to die needlessly. I have an obligation to save you for your own sake, for the sake of your soul."

"I have no need for this body, father," he responded weakly. "My soul will go on."

"Yes, it will," I responded. "But at a time and place of your own choosing."

"My soul is eternal," he said. "I live in others," and with those words my friend, my convert was gone.

He slumped in my arms, surrendering his material self to my embrace, just as I would some day relinquish myself to my redeemer.

I did not know whether his last words were question or statement.

As the day progressed the process of Ttch*lok's softening accelerated. The crack on his back finally extended the entire length of his body. As it began to widen, a rich, redolent fluid spilled out. Ttch*lok's body writhed and squirmed in small random motions that twitched his exoskeleton this way and that. His strength claw jerked upwards at one point and then fell limply to one side. There was no resistance when I lifted it; the muscles had loosened completely.

Heat radiated from his body as the process accelerated. I watched the firm exoskeleton split and easily peel away. The oily fluid that oozed from the cracks must lubricate the shell and permit it to peel so easily, I surmised. As pieces of the shell fell away the white flesh beneath was revealed.

Metaphorically I wondered if, when my own mortal sheath had to be sloughed, it would expose the soft white purity of my soul? Just what were the similarities between us, the parallels in our spirituality? Clearly the mores of this world were at odds with the civilized processes of my own, as I had observed many times in these past weeks. Still, couldn't there be some grace in all of this predation, some salvation from "nature, red in tooth and claw?"

Couldn't the Word of God be brought to these beings?

The smell of the lubricating fluid and the heat radiating from the process began to attract visitors. The small flying insectoids were the first to arrive and landed on Ttch*lok's white flesh, ready to feed. I swatted them away with a branch of *X-Conifer lycanthus* that I tore from one of the shrubs outside of our lair.

The crawling things were harder to deal with. I finally took a few moments to roll a large stone in front of the opening and scooped out a moat in the gray-green mud behind it. The moat immediately filled with water and formed a secondary barrier behind the stone. I used the back of my glove to squish those few crawlers and scurriers who squeezed by the boulder and managed to ford the moat.

As evening fell I heard the larger creatures gathering outside, some of whom were probably wild homaroids. I made shuffling noises to keep them at bay while still waving the branch at the insectoids and keeping an eye peeled for any other crawlers who had forded my moat. I rested not a wink that night as Ttch*lok changed beside me. I tossed pieces of his shell outside as the process continued.

The next day was a repeat of the first, only with greater numbers of flying insectoids and creeping, slithering intruders. My branch was worn to a stick and I had to replace it twice as the day progressed.

Halfway through the day my cooler quit and I began to warm up from the exercise of swatting and squashing. I began to grow thirsty, but refrained from drinking my small water reserve until I absolutely had to. Now that the cooler had gone there would be no more condensation to refill the reservoir.

But regardless of my own discomfort I knew that I must keep my vigil, to guard against those who would steal this soul from my care.

By late afternoon of the second day the entrance to our hideout was littered with the remains of the flying, crawling, and slithering creatures that I had dispatched. In the bright light of day none of the larger predators were visible. That did not mean that they were not there. It only meant that they were biding their time, awaiting a moment's lapse on my part; a nod from me and they could feast on the succulent body lying in repose beside me.

When night fell I could hear the predators coming close, testing my ability to drive them away, testing my resolve to save this soul from the horrors of his own world. Each time I arose and waved my arms in what I hoped was a threatening manner.

I persisted and wondered at last as to why I was doing this. Why, after abandoning my own calling, had I chosen to intervene with this one pitiable creature, this one who was not even of my own species?

My innermost faith had decayed years and years before, long before I embarked upon this journey into the boundless reaches of God's great Universe. And perhaps the reason for it.

How could a priest serve his flock when the congregation was an ever changing aggregation? When they were people who looked upon the rites as performance, who changed churches, religions, and morals according to the fashion of the time?

Sermons meant nothing to them, being merely an interesting phase in the show, much akin to the musician who plays to amuse the audience between acts. Mention shame and they would get up and leave, talk of sin disturbed them, speaking of death was unthinkable, and asking them to believe in the Trinity was impossible.

Despite this, I had to pander to the needs of the age, for it was deemed better to have a flock of marginal Christians (and the money was welcome too) than preach in an empty church. Yet, despite all of my efforts to make those who chose to attend realize the peril to their immortal souls, it took only one popular figure to state that Mithraism was *the* religion and, in an instant, my entire flock would switch allegiance to the temple down the street.

Every waking moment I lived in dread of finding myself without a congregation to care for.

In the end I could stand such lukewarm adherence to the faith no longer. I despaired of mankind ever maturing into a life of belief and spirituality. If we few practitioners, advocates of the faith, could not obtain their commitment then humanity was lost; they would only have the taste of religion without being nourished by the substance.

I abandoned my church, leaving the spiritual care of my two dying parishioners for a younger, and less critical replacement and embarked into God's great Universe on the *Hercules,* searching for my lost faith among the stars. Perhaps there I could find renewal, I had hoped.

Instead I had found Ttch*lok.

By the morning of the third day Ttch*lok's new shell had finished expanding and begun to darken. The exoskeleton was starting to achieve the consistency of leather. This was some relief for me as the smaller insectoids were no longer a problem, for their tiny apparatus could not penetrate Ttch*lok's new armor. I no longer needed to wave my branch and crush the occasional visitor. I rested my arms and sucked a few drops of water, the last of my reserve.

When that night fell the homaroids and other predators still lurked, awaiting their chance. Perhaps when the shell hardened further I would have a chance to sleep, to rest from this vigil, I thought.

As I sat there I pondered again at what I was doing. A disturbing simile occurred to me in that haze of sleep-deprived, semi-critical thinking: the similarity of the homaroids' consumption of the flesh of living thinking beings to the rites I had learned. Was this not a communion of sorts? Wasn't their consumption partaking of the substance of life itself, a sharing of being more intimate than my own ritualistic taking of the flesh and the spirit?

A reason why these creatures had developed no religion occurred to me as well. Each of them was virtually born anew after each successful softening. Each rose after three days, like the Lord, from the false death of mortality, forgetful of their prior transgressions. Each and every one of them was resurrected in a continuous renewal of innocence.

They were living a spiritual life such as I had never imagined.

I cried at the thought, muddled as it may have been. I fervently wished that we humans could do likewise. That we could shed our baggage of sin and pain and return with refreshed souls, able to grace life with greater facility. I yearned that others could drink of my life and experience and so carry it forward to eternity.

But, unlike these blessed creatures, these sorrowfully predatory homaroids, my own sins would not be shed like their exoskeleton but would stay with me unto my final breath, dooming my eternal soul to ascend without a second chance for redemption. Like all humans, I had only one pass at life; one chance to live, and must die with the consequences of my mistakes.

As I'd had to live with my failure to keep my faith.

With these morbid thoughts in mind I must have dozed momentarily. I was started awake by a slight noise beside me and spied a large slithering centipede who, having taken advantage of my inattention, was chewing at one leg of the slumbering Ttch*lok.

I lashed out with my foot, bringing the suit's armored heel down square in the center of the 'pede's back. Its legs kicked as it coiled about to tear at my foot with its sharp mandibles. Several of the pede's appendages tore futilely at the underside of my leg, the piercing spurs on each of its many limbs failing to find purchase in the metal.

I came erect, keeping my foot squarely on its back, holding the creature in place. With a shock I saw that the 'pede's mandibles were actually peeling small slivers of my suit's armor away with each bite. A line of little scratches marked where it had been nibbling.

I placed all of my weight on the 'pede's back and brought my other foot down hard on its head, feeling its crown crack in a satisfying shock that ran up my leg as the gore from its innards splattered in all directions. One more spasm and then it lay still under me, dead at last.

With a feeling of disgust I lifted the thing with both hands and tossed it into the night. I heard the nocturnal predators scramble toward it and then listened to the sounds of a scuffle as they battled over the choice parts.

Then the night was silent once more.

I dozed no more that night but stared at the damage my inattention had caused to Ttch*lok's leg. I had failed in my mission, just as I had failed my flock.

I think I cried then as well.

In the morning I noted some stirring of my charge and, when I looked closer, I saw that there was some movement of his sensory organs. The eyes swiveled toward me, staring blankly. The feelers writhed aimlessly. Was Ttch*lok returning to consciousness, I wondered?

As yet there was no movement in his limbs: Apparently the muscles had not been released from the protective slumber that God had provided to protect him against damage to the still unhardened integument.

After a few moments the eyes closed and the feelers stopped their movement. I prayed that all was well.

Ttch*lok moved no more that afternoon.

To my testing hand the shell appeared to be as firm and solid as his original had been. Few of the insectoids bothered us now. They had learned that they could not penetrate our hard armor. Nor did the crawlers come near. Apparently they had only been attracted by the heat and the smell of the softening fluid and, now that those were gone, had no interest in us.

I was certain that the predators still awaited outside, although I could not see them. Perhaps, I thought in a haze of sleeplessness, I could rest my eyes for a moment, just a moment.

I dreamed of myself as the new messiah of this world, with Ttch*lok as my prophet. I dreamed of the two of us carrying the word of a life free from fear, a life that blessed the sanctity of intelligence for the precious gift that it was, a thing to be guarded and protected. I dreamed of hordes flocking to hear the Word and sharing a true communion of souls, of life and spirit.

But then the dream turned to nightmare as the hordes, misunderstanding our message, fell upon each other, clawing and fighting and tearing and eating at each other in a frenzy, the mass of greenish-gray bodies a massive blur of hideous movement.

I saw my disciple pulled down into the mass and rendered into pieces, surrendering himself in this most intimate of communions.

And then they reached for me.

I started awake to feel something lifting my arm and lashed out, thinking this was still the dream, or maybe fighting some new predator come to call. It was only when I opened my eyes that I realized how wrong I was.

The new Ttch*lok had come fully awake and was standing over me, his huge strength claw grasping my arm while his back legs held my body in place.

A shock of fear went through me: Did this reincarnation retain any knowledge of our relationship? I wondered if he could sever my arm with his claw's sharp edge, an edge that had not yet been dulled with use? I wondered if our friendship and his discovery of faith was among the eighty percent of memory that was lost.

If so then I was surely doomed.

Anxious moments passed with no change to the tableau as my fear grew, for I now remembered how ravenous any homaroid must be after the softening; desperate to replace the energy that had been lost and anxious to consume me and thereby gain whatever knowledge I possessed.

So much did I fear my own rendering at the hands of this horrific creature that I nearly fainted, slumping in the hard suit that surely would be no protection against that huge, sharp claw.

His eyes swiveled this way and that, seeking to make sense of the surroundings. Ttch*lok had been so deep in his pre-sloughing stupor (Was it only four days ago?) that he surely could not remember how we had come to be in this tight overhang.

Finally his eyes came back to focus on me. He reached across and grabbed my other wrist, lifting both wide. "My friend," he said in flawless Italian, "we are reborn."

And with those words he let me go and raced from the place where I had held my vigil, past the rock I had rolled into place, and across the remains of the creatures that I had tossed outside. I had never seen one of the homaroids move so swiftly.

Seconds after he had disappeared into the brush there was a piercing scream and some thrashing sounds. I stumbled out and saw Ttch*lok, or whoever he was in this reincarnation, stuffing the remains of one of the smaller homaroids into his orifice. His strength claw had neatly decapitated the little creature with a clean cut.

The prey had become predator.

I saw no more of Ttch*lok, although I searched the vicinity until darkness fell. I did find evidence that he had hunted vigorously in the short time since emerging: severed armor lay near and far, all cut with that fierce and powerful claw, all emptied of their contents. Apparently he had an understandable drive to replace the energy lost during the softening and was hunting with a vengeance. I waited through the night for him to return, hoping that he had retained enough of civilized memories to come back to his friend and mentor. I was disappointed; I had failed again.

I stayed awake as best I could, waiting against hope for his return. I must have dozed frequently, for the day went by much faster than it should. During my waking moments I recalled my dream and puzzled over what it might mean.

Had I been wrong in taking Ttch*lok from his proper place and secreting him here in the wilderness? Perhaps the ethos of this place was not my own, was not the smooth, disciplined structure humans had evolved over the centuries and which now was contributing to the lack of resolve in our spiritual lives.

Perhaps the rough edges of this barbarous place held a new level of understanding, one built upon the absolute certainty of rebirth, of the knowledge of what true communion contained for the individual.

Had I prevented the emissaries from sharing Ttch*lok and carrying his soul back with them? That possibility worried me more than I cared to think about.

But then I recalled his words upon awakening from his rebirth. "I am reborn," he had said. A modicum of the faith had remained in him and I knew that he would carry it forward. Even if he fell prey to something larger and more ferocious perhaps some part of that faith would be passed along.

And so it would go until the faith was shared throughout this world, shared in the vast communion of predation and love.

I too, must be reborn, I thought in an amazing epiphany. I now realized that so long as a few of the faithful professed the Word and carried the ideas forward into the future, there would be no loss of God's faith in the world. Like the flesh of Ttch*lok we few faithful must surrender our own lives to serving humanity until the day we die and pass a part of that faith on to others.

It is our own way of communion.

In the morning I wearily started my journey back to the dome, wondering what my punishment would be now that I had destroyed our link to the emissaries. I am sure that some of my associates would want to extract a horrid penalty for what I had done, forcing me to pay penance for transgressions real and imagined. I doubted that any would understand why I had to act as I did.

God works wonders in strange ways and to me he had administered a hard lesson; but in that lesson he had taught me a new humility about my role in this life.

And renewed hope for my role in the next. ■

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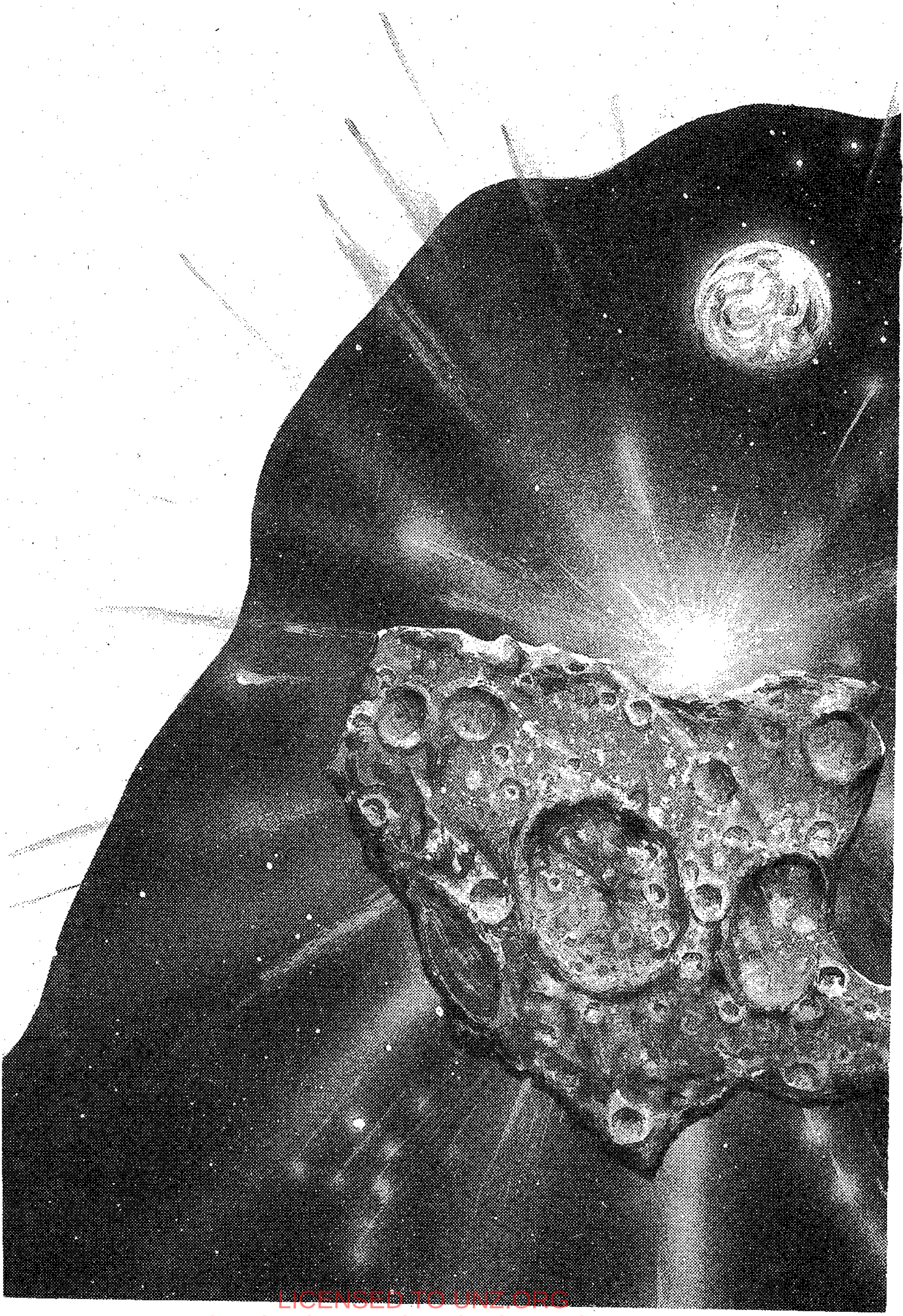
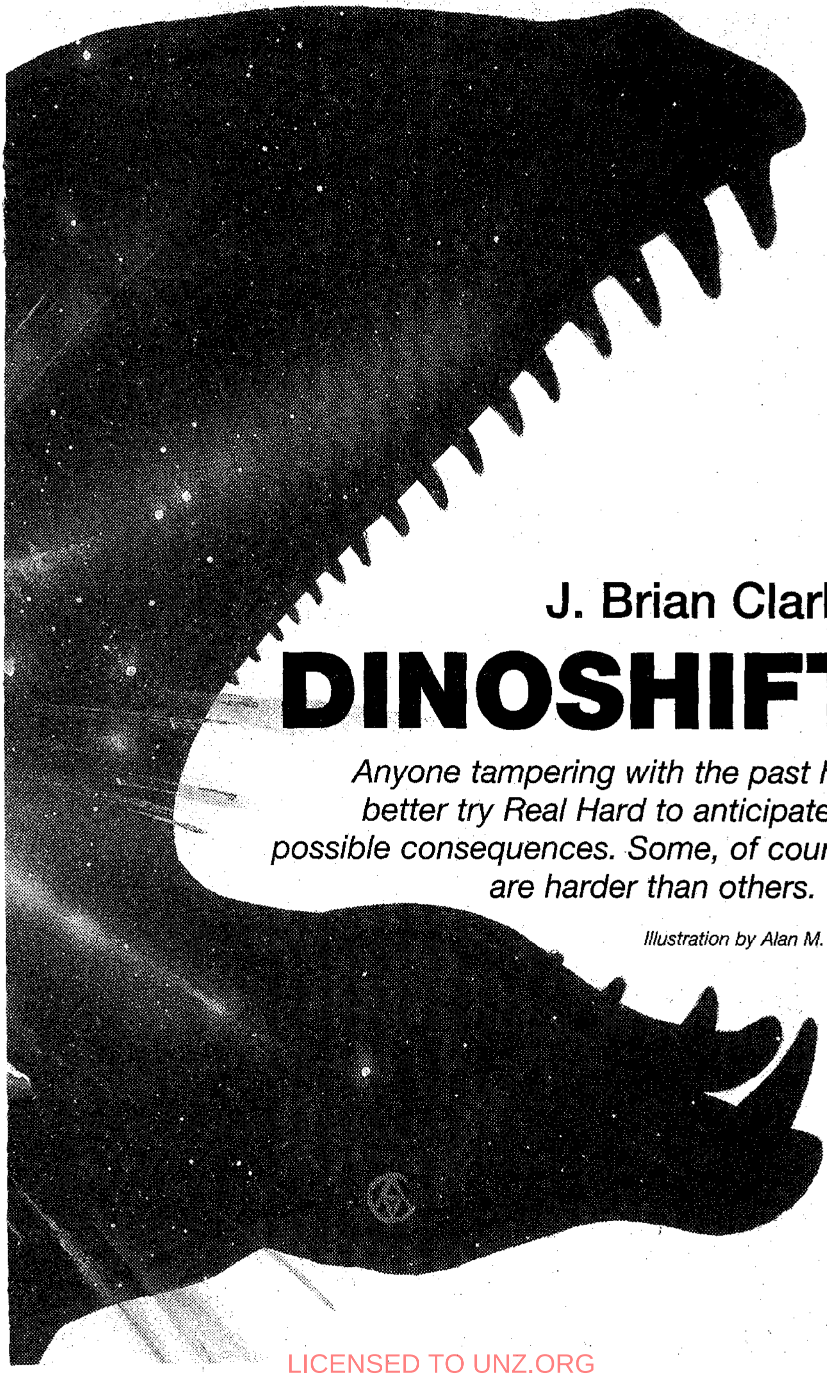




J. Brian Clarke

DINOSHIFT

Anyone tampering with the past had better try Real Hard to anticipate all possible consequences. Some, of course, are harder than others. . . .

Illustration by Alan M. Clark

Stipulation:
The present is inviolable. It cannot be altered by changing the past. The future is not so inviolable—

When Frederick Marion Degruton published his paper *Phased Timeshift Dispersion* in the summer of 2119, critics quickly recalled the ancient arguments against time travel. As one writer succinctly put it, "It makes wonderful science fiction. But fiction can tolerate the contradiction, for instance, of a man going back in time and becoming his own ancestor. Science cannot."

Nevertheless it was not long before Degruton was reluctantly persuaded into a TV studio, where interviewer-journalist Gail Sovergarde turned on her famous charm.

"Dr. Degruton, I understand your paper has created quite a stir in the scientific community. I mean, *time* travel! So I hope you will forgive me if I ask a question I am sure you have already heard a thousand times. Can we now change the past?"

"No."

A small man, sandy-haired and painfully shy, Degruton had decided the only way to preserve his equanimity before this disconcerting female, was to say as little as possible.

"I am so glad you said that." Her smile made him melt. "Because to change the past is to change the present. Is that not so?"

"That is the accepted—" He shuffled uncomfortably, "—way of looking at it."

"But a valid one, surely?"

"I suppose so."

"Ah." She nodded knowingly. "So despite your discovery, I still cannot go back and dispose of my grandfather before he had children."

"Good heavens!" Degruton was shocked. "Why would you want to do that?"

Disconcerted by the scientist's literal interpretation of the elderly cliché, Sovergarde hurriedly rephrased. "Then if we cannot change the past, what can we change? Presuming, of course, time travel is possible."

"Read my paper, Ms. Sovergarde. Believe me, the calculations have been checked and double-checked by the top people in the field."

She held up a folder. "Triple-checked, Dr. Degruton. I have been assured your reasoning is impeccable. So, again, I ask the question. What can we change?"

"Not so much change, as create."

"I beg your pardon?"

"If we go back a couple of thousand years and arrange for the—ah—removal of a certain itinerant preacher before he started his ministry, Christianity would never have happened. Right?"

"Of course. That is obvious."

"Obvious only in another continuum, Ms. Sovergarde. Not in our own—in which Christianity is an incontrovertible fact."

"I see." After a slight hesitation, Sovergarde asked thoughtfully, "You are talking about an alternate history, aren't you?"

"Well I—" Degruton looked at the woman with dawning respect. Never much interested in the comings, goings and various scandals associated with the current crop of video personalities, he came to the interview assuming this was just another shallow, statuesque brunette with the gift of gab and an astronomical clothing budget. But with the sudden realization that Sovergarde was more than just flesh-and-blood cardboard, the scientist blushed and began to stammer. "Y—yes, in a—ahemm—sort of—"

Her smile was disarming, and with an effort of will he forced himself to meet her questioning gray eyes. Somehow, her projection of innocent curiosity inspired confidence. "You are familiar with the concept of alternate histories, Ms. Sovergarde?"

"In a science-fictional sort of way. As I understand it, if someone from our time goes back and changes or prevents some pivotal event of history, instead of altering *our* past, the time traveler has by his action created a branching alternate in which, for instance, Christianity never existed. That alternate would be another timeline, parallel yet separate from our own."

"Timeline is the popular word. I prefer continuum. Anyway, in the greater multiverse of which our own cosmos is but an infinitesimal part, it is conceivable that infinite possibilities already coexist in an infinite series of continuums. By the way, I erred when I implied alternates are created. Any manipulation of a past event simply opens the door to the most appropriate of those infinite possibilities."

"But it is so theoretical."

"Not at all. In fact, my colleagues and I have already demonstrated the concept in the laboratory. The partitions are not impenetrable, you see. We set up an experiment in which we changed an event in past time, returned to the present, and then shifted sideways to observe the consequences of our manipulation."

Sovergarde lifted both hands in protest. "Partitions? Sideways? Sorry Doctor, you just lost me."

"The experiment was on a modest scale of course, involving nuclear reactions over nanoseconds of time. Partitions are simply the boundaries separating the alternate continuums from each other as well as from Prime, which is our own continuum. Sideways refers to our ability to shift across those partitions."

"Getting back to Christianity—"

Suspecting he should have chosen a less controversial example, Degruton sighed. "If our time traveler somehow prevents Christianity 'getting off the ground' so to speak, he then has the remarkable option of being able to follow the development of a non-Christian continuum at any moment during its history, up to and including the alternate's calendar equivalent of our present."

"But not beyond?"

"Beyond?"

"Into the future."

Degruton looked wistful. "That would be interesting, wouldn't it?" He frowned and shook his head. "Unfortunately, that is one barrier beyond which we cannot go. As with the speed of light, nature has its limits."

"So the future can only arrive the old-fashioned way?"

"By becoming the present? Precisely."

Sovergarde pursed her lips with disappointment and consulted her notes. "About this technique—"

"We call it Shift Dispersion, or SD."

"All right, SD. Does it have a practical application?"

"Does a baby, Ms. Sovergarde? Give it time."

"Then do you have anything in mind? I mean, on a larger scale than the experiment you just described?"

"Oh indeed."

"Can you tell me what it is?"

"Not really. After all, we are at the beginning of years of development work. But perhaps—" Degruton hesitated, then added weakly, "Really, it is rather premature."

The famous Sovergarde smile. "Oh Doctor, do tell."

Degruton blushed, took a deep breath. "Dinosaurs."

Ten years later.

The *Francis Bacon* was a big ship, originally constructed as a bulk carrier for the Mars run. Now rebuilt to carry the massive SD generator in the main hold, her Sovergarde fusion-drive had brought her to station above the ecliptic in just over nine weeks.

Despite the ship's size, personnel quarters were limited and cramped. So the presence of Gail Sovergarde, in addition to a dozen scientists and technicians, was initially resented by those of the ship's crew who assumed the journalist's only asset, other than her looks and her network's financial resources, was her famous grandfather. But Gail's willing acceptance of routine chores, plus her charm and obvious intelligence, soon made her friends with everyone—including, to Degruton's surprise—the other four women on board.

Degruton's own relationship with this surprising female had matured over the years to something he thought was even better than marriage. Their commitment had no formal contract, their work frequently kept them apart, yet every reunion had the giddy, sensual aspect of a couple of teenagers discovering each other for the first time.

But it was entirely business when Gail entered SD Control as Degruton and a couple of colleagues anxiously watched data scroll across a screen.

"How's it coming?"

Without looking around, Mary Scheaffer waved a hand. "Hi, Gail."

"That bad, huh?"

"Not really. Just the usual glitches."

Gail glanced at the countdown display on the bulkhead. "Seventeen hours to go. Are we going to make it?"

"Damn right we are." Mike Brown, the other member of Degruton's primary team, swung his chair around and grinned at the tousle-haired journalist. Even at forty-two, with no makeup, a touch of gray in her dark hair, and clad in a baggy coverall, the journalist continued to attract the appreciative male eye. Mike added, "What about your doubts, lady? Still have them?"

She shrugged. "I am like a lot of people, I guess. Intellectually I know we can't change our own past, and have proved it. But gut-wise—"

Her mind went back four years, to the first full-scale test of SD. She remembered the nerve-wracking hours during which she wondered if man had finally tweaked nature's nose once too often—

From a site in Nebraska, they time-shifted to around 500 A.D. and released a few horses into the broad grasslands of first-millennium America. A dozen mares, a few foals and a couple of stallions galloping away across the prairie, hardly seemed enough for the nucleus of a viable population. Yet Alternate 1-2125, the modern-time equivalent which was the result of that experiment, turned out to be a revelation—with Europe still in the steam age, and its few North American coastal colonies warily co-existing with a continent-spanning Inca Federation.

Unlike Prime, in which a few hundred mounted conquistadors under the leadership of Cortés and Pizarro conquered the Americas for Spain, in A1 the thundering cavalry regiments of the Inca had been more than enough to snuff out the European upstarts.

Despite Gail's misgivings, the return to Prime was anticlimactic, proving what Degruton and her own common sense always insisted—that because Prime's past was unalterably written into the fabric of spacetime, its present, although older by the six weeks subjective time they were away, remained as familiar as an old and comfortable shoe.

Yet the nagging voice remained, like a constant itch that could not be scratched—

Gail blurted, "It's not so much what we're doing, Mike, as the degree of what we're doing! Introducing a few horses a few hundred years before their time did not seem such a big deal, yet look how that ended up! Now we are about to do something on a global scale." She took a deep breath. "All at once!"

Aware Degruton was also looking at her, she snapped, "What is the matter, Freddy dear? Am I repeating myself again?"

"I am afraid you are, dear." He smiled and rubbed a hand through what was left of his hair. "Anyway, do you think you can stop it?"

It was not a challenge; he was not that type. It was a simple question.

Gail admitted wearily, "Of course not. I only report events, I don't influence them." She hesitated. "But I do try, don't I?"

"Damn right you do. Fortunately our dedication is immune even to your charms." Degruton stretched aching muscles and yawned. "Anyway, one or a thousand new alternates, it doesn't really matter. Prime will still be there when we get back; slightly soiled and slightly glorious as always, but there."

Gail whispered. "But we're about to create a whole new Earth. Totally different—"

"Create?" Degruton shook his head. "It beats me why you insist on looking at it that way. We are not God, you know."

"I know. It is what worries me."

Although the calculations were meticulous and had monopolized the Luna Institute's computers to the extent a deputation of angry cosmologists demanded Degruton either stop or get out, the results were still based on theory. So when one of the detects reported a mass approximately where and when it was supposed to be, excitement was tempered by doubt as they waited for refinement of the incoming data.

"Coincidence?" Mike wondered aloud. "Or just bloody good luck?"

"We will know for sure in an hour or two," Degruton muttered as he watched the wavering blip on the screen.

"Why so long?" Gail asked.

"The detects are pretty widely spread, in space as well as time. Twenty-Three is doing its best, which is not too bad for a probe the size of a basketball. Eight is coming within range, and Forty-Eight is not far behind. Those three should give us a pretty good fix."

"But you launched more than a hundred!"

He looked up. "I'd have launched a thousand if we had the budget and room for that many."

"Three percent." Mary paused, added thoughtfully, "You know, that's not so bad."

Degruton nodded. Based on data from thousands of core samples taken in and around the asteroid's supposed impact point near the Yucatán peninsula, the computer's projection of the incoming trajectory turned out to be both surprising and fortuitous. The asteroid had been a rogue; a solitary interstellar interloper arcing into the Solar System from high above the ecliptic. Unlike the countless anonymous chunks of cometary debris which had always orbited the Sun, this was a loner which theoretically could be located. Hopefully, they had done exactly that.

Mike checked the readings. "Minus sixty-six million years, give or take a couple of hundred thousand. Close enough, I'd say. Let's arm Bertha."

Degruton shook his head. "Not yet. Bertha stays asleep and harmless until we are absolutely sure."

So they waited as the cloud of tiny detects which had been launched in a fan-shaped pattern north of the Sun, flickered in and out of time and space. Snug in its bulge on the underside of the *Francis Bacon,* enough explosive power to cinder half a continent or divert an asteroid continued its mechanical slumber.

The pattern on the screen changed.

"Eight is within range," Mike reported.

"And—?"

"Just a sec." Mike checked the scrolling figures. "Intersect in 290 days."

"Intersect?" Gail queried.

"With Earth's orbit. So far the data's not complete enough to determine if there will be actual impact. Whatever it is could still miss by a couple of million klicks."

"Equivalent to a bullet parting your hair," Mary explained solemnly. "Unpleasant, but not fatal."

"Not this baby," Mike declared flatly. "It's it!"

"What makes you so sure?" Gail asked as she tried to ignore the sinking feeling in the pit of her stomach. "As Mary just said—"

"—If it looks like a duck and quacks like a duck—"

"—It is the asteroid that wiped out the dinosaurs," Degruton interjected tiredly as he lifted both hands and rubbed his temples. He took a deep breath, pressed a switch. "Gerry? Time to wake up Bertha."

The voice of Captain Geraldine Fuchs echoed the doubts of Gail Sovergarde. "Are you sure? I don't want to commit on a hunch."

"You are watching the data?"

"Of course."

"Then be honest, Gerry. You know damn well it's no hunch."

A sigh. "When will you know enough to commit for launch?"

"We have enough to commit right now. We can tweak Bertha's course as more data comes in."

"OK. We need half a day for checkout. Launch any time after fourteen hundred hours tomorrow."

Later, Gail slipped out of SD Control and hauled herself up the access well to the bridge. She found the captain alone, standing in front of a direct vision port and staring at the stars. The captain did not turn around as the journalist entered. Instead, she wondered aloud, "Do you think we will ever get there?"

"Where?"

Fuchs gestured. "Out there."

"Of course we will."

The captain turned around. Her thin, bony face was expressionless. "What makes you so sure?"

"Because there are people like you and—" Gail hesitated.

"Degruton?"

"Yes."

"I wonder."

Fuchs returned to the command chair. "I will do it, of course. Launch, I mean. And I will watch and dutifully applaud when Bertha explodes and nudges that asteroid so it won't hit Earth sixty-something million years ago."

"And then?"

"I won't sleep a solitary wink until we get back and find home is where and how we left it!"

Gail sat down at the vacant first officer's station. "Me too," she admitted. She looked around the deserted bridge. "Where is everyone?"

"Down below, with Bertha. I may be uneasy about it, but I intend to have the job done right."

"Gerry, the concept has been proved. Whatever new alternates we create or open up, Prime's present is untouchable. It cannot change."

The captain nodded. "You were there when they did the thing with the horses, weren't you?"

Gail nodded. "I was also there when they time-shifted ahead fifteen centuries to see the outcome."

"What kind of world was it?"

"Is," Gail corrected firmly. She took a deep breath. "Steam trains, paddle wheelers, gas lights, one or two minor wars. A Tudor named Henry the Tenth on the English throne, and a North American federation of Inca chiefdoms with not much technology beyond good roads and the telegraph. I could have survived on that world, I suppose, but I was glad beyond relief when we shifted back to Prime."

"I can believe that."

Fuchs stared at her visitor from below lowered eyelids. She found Gail Sovergarde pleasant enough, as long as she did not dwell on the contrast between the journalist's lush looks and her own scrawny hair-in-a-bun appearance. "You still wonder if we're spitting in God's eye, don't you?"

"I wouldn't put it that extreme."

"I would. I have a nasty feeling we are going to regret this."

"I already told you—"

"I know. We cannot change Prime's past, and Freddy and his team have already proved it. But I suspect you don't like this dinosaur thing anymore than I do, Gail Sovergarde."

The other woman shrugged.

"OK, so we divert that asteroid. Then what?"

"We spot check over a few million years," Gail replied, relieved the conversation had moved to safer ground. "See what happens."

"Up until the present equivalent time?"

Gail shook her head. "I thought that was the obvious thing to do, until Freddy reminded me that we humans only got started pretty recently."

"What has that to do with anything?"

"So what would we be like today, if our primate ancestors climbed down from the trees during the Mesozoic and not just four or five million years ago?"

"We'd be—" An awed expression crossed the captain's thin face. "Pure intellect?"

"Perhaps. Or maybe we would have long since polluted ourselves to extinction. No one knows. The point is, Freddy would rather not expose us to whatever remote sensing capabilities those distant dinosaur descendants might have. Presuming they do evolve intelligence, we will shift back to Prime long before they develop space flight."

Fuchs nodded, slowly. "It seems Freddy has thought of all the angles."

"I think so. It is why my objections have been—" Gail's smile was wan, "—muted."

With a huge sigh of relief, the captain leaned back in her chair. "You know, although I felt in my bones there was something wrong, I could not figure out what it was. Now you've told me—and it's pretty awesome—I am glad our lord and master decided to avoid it." She smiled broadly. "Dammit, I feel much better!"

Bertha was launched on schedule. The detects had done their job, plotting the exact course of the mountain-sized wanderer to a point of impact on the Earth's surface corresponding to what would be—in sixty-six million years—the Yucatán peninsula.

The asteroid was still one hundred and ninety million kilometers from Sol's third planet, when proximity fuses exploded Bertha's fusion warhead just above the cratered surface. On the screens it was a mere wink of light.

For better or worse, it was done. There would not be another try. Bertha was a one-shot.

Detect 23 was destroyed by the

blast, 8's sensors were overloaded beyond recovery. So it was nearly three days before the *Francis Bacon*'s own instruments, plus data from the lagging Detect 48, finally confirmed that Mesozoic Earth was saved by a margin of slightly less than five hundred thousand kilometers.

A few years later, Gail Sovergarde dictated into her journal:

And then we flitted from eon to eon like gods watching the progress of their children. We saw icecaps advance and retreat. Deserts, forests and plains shrank and expanded according to the great cycles of nature. The dinosaurs themselves changed, becoming smaller, swifter and more intelligent. The giant carnivores and herbivores were extinct within ten million years after AV (asteroid avoidance), after which a few species of four-footed mammals emerged on the plains. There were no mammal primates.

We overshot the genesis of the dinosaur toolmakers by some one hundred thousand years, but not their early villages near the great rivers on both continents. We watched as the villages became towns, as agriculture spread and roads linked the towns in a great web of commerce. Square-riggers sailed the seas.

There were no wars.

Perhaps the lack of conflict is why technological progress was, by our standards, inordinately slow. It took more than five hundred centuries for the dinosaurs to evolve from early agriculture to the equivalent of a steam-powered industrial revolution. It was another two hundred centuries before the development of the first dirigible, and centuries more before mixed fleets of dirigibles and lumbering heavier-than-air freight carriers flew in their skies. By our time, it was forty-five million years ago when we prudently shifted out from that timeline and returned to Prime's familiar present.

For a few hectic months I traveled with the SD team from city to city, and then to the Mars colonies. I shared the accolades, although even Freddy freely admits my coaching contributed in no small degree to his blossoming as a public personality.

Still, as always, there were the questions.

Also, as always, the doubts.

No one, not even Freddy, was particularly surprised when the ban was imposed almost exactly one year after our return from the Dinosaur Alternate. Although the SD projects had not triggered the space-time discontinuance forecast by Stennerdahl and others, in its collective wisdom the Assembly instructed the Secretary General to suspend the Shift Dispersion program pending "further investigation of any deleterious effects on the environment."

So it was done.

The Francis Bacon *resumed its unglamorous role as an interplanetary freighter. Captain Geraldine Fuchs joined the fledgling interstellar program, and I semi-retired from the small screen to become a director of the network. Frederick Degruton did not do much of anything, other than spend most of his waking* *hours going through the voluminous reports of Project Dinoshift, eating and showering when he was reminded to do so, catnapping but never getting a proper night's sleep, and frequently muttering something about "What we can do—"*

After a couple of months of this, I moved out. Because I assumed we were still friends, I tried to keep in contact with Freddy. But he did not return my calls or answer my messages. Finally, in desperation I returned to the apartment. As I expected, he had not bothered to reprogram the maglock—

He was asleep. For a few seconds Gail stood in the doorway of the familiar bedroom, watching as he snored softly. To her surprise the place was clean. His clothes were neatly folded over a chair, and what she could see of him was scrubbed and clean shaven.

But his face was painfully thin.

She checked her watch: 10:30 A.M.

In the old days, he was up by six. It was an irritant she had learned to live with, as she ignored his puttering around until she later joined him for breakfast.

That was another life.

Letting him sleep, Gail left the bedroom and wandered into his office. Again total neatness, in contrast to the chaos of tapes, disks, books, and paper strewn about the room the day she left. He had two terminals going at the same time, she remembered, each hooked into a different data base, neither ever being turned off. She also remembered their bitter words, when he refused her request to use one of the terminals after her portable crashed while she was uploading to the network.

On the evening telecast of that day, she had to use someone else's copy.

Now there was just the one terminal, turned off, the keyboard placed with mathematical precision in front of the screen.

"Gail?"

She turned. He stood in the doorway, blinking sleepily. "Hi, Freddy."

He did not seem particularly surprised as he asked, "What are you doing here?" For all the expression in his voice, he could have been inquiring about the weather.

She shrugged. "I was worried. You won't answer my messages."

He nodded. "Give me a few minutes to do this and that, then we will talk."

Gail watched as he went into the bathroom and closed the door. "This and that" was an expression from their intimate days, and her heart skipped a beat when he used it. On the other hand, neither of them had ever completely closed the bathroom door.

Guess there's not much of the old magic left, Gail mused sadly, as she went into the kitchen and busied herself putting out fruit juice, milk and a couple of bowls of cereal.

When he came in, clad in a white shirt and slacks that once fitted but now hung on his scrawny frame like an older brother's discards, the journalist had to force herself not to overreact. She simply commented, "You have lost weight."

"I know." He grinned. "Guess I had better start eating again."

She went to the autochef and called up a preset program. It had not been changed. "Eggs, toast, and bacon just as you used to like them. OK?"

"OK," Degruton agreed as he began to spoon up the cereal.

During the next half hour Gail did most of the talking while he ate and drank profusely. It was a chatty one-sided conversation in which she described her new job at the network, the day she spent in the company of the Secretary General at the World Assembly Building, her new corner office on the 130th floor, and the delight of her parents when she introduced them to the cast of the eternally running soap, *Tomorrow's Day*.

Finally, he pushed himself away from the table. "Thank you."

"For the food or the talk?"

"Both. But especially for the talk."

"In the trade, it's known as verbal diarrhea."

"In your case, that is like calling a rose a skunk cabbage. Gail, you are the only person I know who can make even a discussion of potato blight interesting."

"Potato blight? When did—?" She took a deep breath. "Dammit Freddy, I am having the hardest time not discussing you!" She glared at him. "No, not just you. Us!"

Degruton reached over and patted her hand. "I know, and I apologize."

Is this about to become one of our reunions? Gail wondered giddily as she tried not to look in the direction of the bedroom. She hoped not. He looked frail enough that a simple hug might break him.

But if she was gentle—

Instead, he said, "As much as anyone, you are the one to blame for the past few weeks."

The letdown was so complete, she could only gasp. "Freddy!"

"After all, you did spend a lot of time and energy trying to get me to call off Dinoshift. So when we finally got home and found everything as it was supposed to be, I was tempted to make you eat your words."

"But you didn't."

"Didn't have the heart for it. Instead, I knocked myself out reviewing the whole project from conception to end. I did not know what I was looking for anymore than you knew what was wrong, but the further I got into it, the more I had a nasty feeling I was missing something fundamental; like not seeing the forest for the trees."

Gail said helplessly, "Freddy, I don't—"

He was remorseless. "Your instincts were right, of course. I did miss something. And it is because of my bloody stupidity, life for all of us—all of humanity—may become very precarious."

Gail just stared at him. Physically, Degruton had lost a lot during the past few weeks. But his eyes were bright, and his words were those of a man who knew exactly what he was saying. She licked her lips. "What have you found that is so—" she fluttered her hands, "—devastating?"

He beckoned. "In my office."

She followed him into the unusually neat room, and sat down as he tapped keys. He said over his shoulder, "We were looking for the killer asteroid. Right?"

She nodded. "And we found it."

"Meanwhile, the ship's sensors were scanning the local region of space."

Gail shrugged. "I learned enough while I was on board to know space is not as empty as it seems. The computer routinely plots the movement of every bit of cosmic flotsam within range, and alarms the bridge if anything is a potential threat."

"Exactly. Not being particularly imaginative, the computer doesn't give a damn what it detects, as long as whateveritis isn't on a collision course with the ship. In fact, unless instructed otherwise, the computer even ignores any object which changes direction."

"Like a ship, you mean." Gail thought a moment, added, "Makes sense, I suppose. There are a lot of ships—" Her eyes widened. "But not sixty-six million years ago!"

"And even in our time, not above the ecliptic." Degruton grinned. It was a peculiarly humorless expression. "You are almost ahead of me, dear."

He pointed at the monitor. "See that trace? It was noted and recorded while we were determining the trajectory of the asteroid. Course approximately paralleling that of the rock, but separated from it by a couple of hundred thousand klicks. Now look at the trace from about the time Bertha exploded, and continuing until we time-shifted out of there."

"It's—" Gail was not an expert, but after months aboard the *Francis Bacon*, she knew what she was looking at. "It changed course!"

"That's right. Even after Bertha shoved the asteroid into an Earth-missing trajectory, the object continued to maintain exact station with that confounded chunk of rock." The grin relaxed, became a smile. "Interesting, wouldn't you say?"

"Interesting," she echoed weakly. She stared at the innocent blip on the screen. "It is a ship, isn't it?"

He nodded.

"Not one of ours?"

"How can it be?" Degruton asked reasonably.

It was not the answer Gail Sovergarde wanted to hear.

Earth's first multi-generation starship was still under construction. It was not scheduled for completion and launch for at least another five years, and then its crew would not see another world during their lifetime. It was their unborn grandchildren and great-grandchildren who would set foot on the fourth planet of Epsilon Eridani. So on the threshold of what was hailed as mankind's greatest (and most expensive) adventure, it was a humbling realization to know an alien star explorer had already visited the Solar System sixty-six million years ago.

It was as if Degruton read Gail's mind. "You are thinking it was a visitor from outside. Right?"

She nodded. "Of course. What else can it be?"

"Too small," he said. "That trace is of an object comparable in size to the *Francis Bacon*. Big, but not big enough to carry generations of star travelers."

The journalist shrugged. "Perhaps it is a scout. One of several launched from a mother ship."

"Too big. I told you, only something comparable to the *Francis* could return an echo that strong."

"FTL."

"I beg your pardon?"

"Faster-than-light!"

"Nah." He shook his head. "Good science fiction, bad science."

Gail was getting irritated. She muttered, "Small and sublight. So it's either a robot, or manned by a crew kept in stasis during the years or centuries of transit."

Degruton addressed the air. "What do you know? She is as smart as ever." He shook his head. "Nevertheless, I don't think so. Although you just mentioned a couple of remote possibilities, there is another scenario which is much more likely."

"And that is?"

He told her.

Gail stayed with Degruton that night. She needed his company, although she persuaded herself it was the other way around. Yet Degruton was the one who after months of self-deprivation was now calm and rational, who had suspected a problem, discovered the nature of the problem, and then solved it to his own satisfaction.

That his solution anticipated the probable end of human civilization as everyone knew it, did not seem to bother him. He was transformed into a dispassionate observer, apart from life as a reader is apart from the characters and events in a novel.

Could they tell anyone of his conclusions?

Dare they?

Gail did not understand how Degruton could sleep as if nothing had happened, while she lay beside him and stared at the ceiling.

After all, even if he was wrong and mankind muddled through the next few decades more or less according to the prognostications of most futurists, there was no guarantee it would remain that way. Although "to the stars" had been the battle cry for generations, and the culmination of that yearning was currently nearing completion in lunar orbit, there were still those who persisted with the disconcerting question, "But what if the stars come to us first?"

Most people preferred not to answer that question, or even consider it. Although Copernicus had forever dislodged mankind from the center of the Universe, an unconscious but stubbornly insistent part of the human psyche held to the myth of human exclusivity. Degruton's new evidence had the potential to shatter that exclusivity—although the threat was not from the stars, but from a co-existing continuum barely a thought away in space, and eons ahead in time.

Frederick Degruton had solved his problem.

But for Gail Sovergarde—journalist, instant insomniac and a member of the human race—the problem was just beginning.

It could have been the biggest

scoop of the age, perhaps even of the past millennium, although that would predate the media by a few centuries. Yet despite the nagging insistence of Gail's journalistic instincts, she continued her duties at the network as if nothing had happened. It was a burden she doubted she could carry for long. Either she would throttle Degruton, or vent her frustrations on some of the expensive appliances and furniture which were still unpaid for despite her exorbitant salary.

She even considered the purchase and installation of a punching bag.

But what Gail assumed was the scientist's indifference, turned out to be a psychological smokescreen covering up an intense guilt. Degruton was convinced he had opened the ultimate Pandora's box, and his guilt unleashed a side of his personality which, over hours of equal parts of cajoling and pleading, finally wore the journalist down to acceptance of his insistent, "No one must know about this. Ever!"

Ultimately, everyone *would* know. It was inevitable. But until then, as Degruton added with uncharacteristic passion, "Let people live their lives as if the future is theirs. After all, until my stupid meddling, it was!"

Months went by.

Years.

Degruton immersed himself in theoretical physics, cutting himself off from all practical work. "A balanced equation is a lovely thing," he told Gail, "but only if it remains a mental construct apart from any hardware."

She doubted such a divorce was possible, especially considering the economic times and the natural requirement to recover costs. But she supposed the intellectual inertia of the academic establishment would keep the high-profile physicist going for a while, at least until some eagle-eyed bureaucrat cut off his research grants pending a review of "potential financial benefits."

The *Gaea Messenger* was finally launched toward Epsilon Eridani, along with its complement of three hundred men and women, including second-in-command Geraldine Fuchs. In ninety-five years—barring accidents, epidemics, and whatever other hazards might wait between the stars—more than two thousand descendants would establish themselves on the verdant fourth planet.

But before man could reach the stars—

The *Messenger* was barely beyond the orbit of mighty Jupiter, when the alien ship appeared as if out of nowhere and assumed exact polar orbit just above Earth's atmosphere. The alien did not communicate, did not interfere with local space traffic, and did not react to close inspection by a dozen remotes sent out from Orbiting Complex Three.

The visitor was a 120-meter soap bubble; perfectly spherical, almost completely reflective, and apparently without inertia. When one of the remotes extended a manipulator to touch the sphere, the sphere simply floated away—as if indeed it were merely a thin skin enclosing a vacuum. Eventually men joined their machines at this orbiting mystery, where they applied everything from diamond drills to a fusion torch in fruitless attempts to obtain even a few molecules of the stuff comprising the silkily smooth curvature.

Perhaps it would have been better if there was a minimum reaction to the crude probing, like a man brushing away mosquitoes. At least it would be a recognizable display of irritability. Worse and completely demoralizing was the sphere's indifference, as if mankind's most advanced technology was as ephemeral as a puff of smoke in the wind.

It was on the fiftieth day after the sphere's arrival that something finally happened. It started with a small bulge, which gradually expanded until it was a ten-meter miniature connected to the parent sphere by a narrow neck of glistening material. It remained that way for a few hours, during which men in their service pods gathered to watch this monstrous birth.

Suddenly the smaller sphere separated, wobbled, and began to descend toward the Earth.

When Gail and Degruton arrived at the Cape, the smaller sphere was already on the ground amid a ring of apprehensive dignitaries, scientists, and technical people.

"At least they had the sense not to use the military," Gail muttered as she and her companion were ushered through the crowd to where Douglas Gruinne of the World Space Organization stood with Alexander Duvenov of the Physics Foundation. Duvenov, a small intense man whose genius as an administrator overshadowed his previous career in cosmology, glowered at Degruton, "It's about time. If that thing starts popping at us, I want to be damn sure Frederick Degruton is in the line of fire!"

Degruton blinked. "I don't understand."

"Come on man, it didn't come from the stars—we have enough detects scattered around the system to spot anything incoming half a light-year out! The monster, that—that—" Duvenov almost spluttered as he gesticulated at the gleaming ball which had touched down so delicately it had not even bent a blade of grass, "*—thing* came out of—shifted into our continuum just like the *Francis Bacon* once shifted out. Remember?"

Degruton felt Gail's hand grope for his. The warmth of the contact steadied him. "You figured it out, did you?"

"That someone might follow you back across the partitions to Prime?" Gruinne shook his gray, shaggy head. "No, not really. Only when Big Mother popped into existence, did we suspect Shift Dispersion might have something to do with it."

Degruton wanted to feel triumphant, instead felt an intense sadness.

It had happened.

Finally.

He doubted the visitors (presuming there was more than one) intended evil, or if they intended anything at all other than to satisfy their equivalent of curiosity. And he doubted they would be gone soon. Eons more evolved than humanity, they would not be bound by the tyranny of time. For them Earth was a zoo, with mankind the main exhibit. As far as man himself was concerned, the pride which had pointed him toward the stars would inevitably wither to dull acceptance of his subservience in the Universe.

Duvenov and Gruinne had obviously figured out part of the answer. But if they knew the whole story—

There was a concerted gasp from the crowd as the side of the sphere rippled and a being stepped out into the sunlight.

The being was neither beautiful or horrible.

It was simply—different.

Definitely humanoid, a little more than two meters tall, with a graceful body topped by a slender head with large golden eyes, the being walked directly to Degruton. At first the scientist thought it was naked, until he realized the silver-gray skin was a tight, form-fitting covering which left only the face exposed. Dominated by those golden eyes, the face had twin nostril slits, a thin lipless mouth and no chin. There was a faint rough texture to the greenish skin; perhaps all that remained of its dinosaur ancestry.

"You are Degruton." The voice was contralto, without accent and no inflection.

"Yes," Degruton replied. Gail's hand tightened on his.

"You expected us."

So there are more of them. How many aboard the mother ship? Just one? Or maybe a thousand?

Degruton glanced at the nearby gantry from which his and Gail's shuttle had departed to rendezvous with the *Francis Bacon*. The being's choice of landing spot was almost poetic.

"I—" He swallowed, "—think so."

"That is good. The circle is complete."

"I do not—"

"Who created the conditions for what, small one? It is debatable. However we know what you did, and are grateful. Nevertheless there are alternates, and there are alternates within alternates. When we investigated the past history of our planet and determined the near miss of the asteroid, we wondered what the outcome would have been if the asteroid had indeed impacted. So we effected a minor readjustment."

It was too much.

Frederick Degruton and Gail Sovergarde exploded into hysterical laughter. ■

> The only justification in the use of force is to reduce the amount of force necessary to be used.
>
> —*Alfred North Whitehead*

THE REFERENCE LIBRARY Tom Easton

Beowulf's Children, Larry Niven, Jerry Pournelle, and Steven Barnes, TOR, $23.95, 382 pp. (ISBN: 0-312-85522-2).
Carlucci's Edge, Richard Paul Russo, Ace, $5.99, 295 pp. (ISBN: 0-441-00205-6).
Door Number Three, Patrick O'Leary, TOR, $23.95, 384 pp. (ISBN: 0-312-85872-8).
Rock of Ages, Walter Jon Williams, TOR, $21.95, 287 pp. (ISBN: 0-312-85963-5).
Alvin Journeyman, Orson Scott Card, TOR, $23.95, 382 pp. (ISBN: 0-312-85053-0).
Freeze Frames, Katharine Kerr, TOR, $21.95, 285 pp. (ISBN: 0-312-89044-3).
Four Ways to Forgiveness, Ursula K. Le Guin, Harper Prism, $20.00, 228 pp. (ISBN: 0-06-105234-5).

In 1988, I reviewed Larry Niven's, Jerry Pournelle's, and Steven Barnes's *Legacy of Heorot,* in which human colonists on the far world of Avalon encountered an apparently benign island ecosystem from which sprang monsters, grendels, which almost killed them all. Fortunately, the humans displayed the famous human ferocity and wiped the grendels off their island. End of problem, end of most excellent and rousing story.

But Niven, Pournelle, and Barnes had far too intriguing an ecology (with thanks to biologist Jack Cohen of the University of Warwick) to drop it there. The grendels had to be so deadly in order to cope with some feature of their environment—presumably something almost as bad, or perhaps even worse from the human point of view. Obviously, there was a story there.

And here it is, eight years later, the sequel, **Beowulf's Children.** The focus is on the second generation of colonists, the children of those who destroyed the grendels and made the colony safe. There is conflict between the Firsts, who remember the crisis and are *very* leery about expeditions to the mainland, and the Seconds, who feel the Firsts are overcautious, soft in the head, and besides, the mainland is just *waiting* for them.

"That," say the Firsts, "is what we're afraid of." But the headstrong Seconds, led by Aaron, a manipulator who would be king, refuse to listen. When mysterious explosions cripple an automated mine on the mainland, they go to investigate and repair. Sadly, despite cautions, despite a lack of grendels,

something strips a man, a woman, and two dogs to the bone, sparing only a baby wrapped in a blue blanket. And automated cameras see only a dust storm.

Meanwhile, here is Old Grendel, showing signs of awareness, building in intelligence, wondering about these strange creatures she calls "weirds," suppressing her instinct to slaughter so she can study them, wondering if perhaps they might not hold an answer to the death wind that kills even grendels.

After the dust storm disaster, the Firsts pull the colony back to the island. The Seconds soon rebel and head back to the mainland. Aaron shows a powerful talent for arranging things so they work out just the way he wants them, even though that may mean people die. There are resentments, rivalries, conflicts between Firsts and Seconds, Seconds and Seconds, parents and children. And the Seconds set up a subsidiary colony on the mainland, where they soon discover that some kinds of grendels can cooperate with each other. They also find something rather like a carnivorous bee loaded with the same substance ("speed") that allows a grendel to move like greased lightning. There are millions of these bees in underground nests, and the weather is changing, promising floods that will drive them into the air.

Meanwhile, Old Grendel is growing more intrigued than ever. And that's about all I want to tell you, because you *are* going to rush right out and buy this one (if you haven't already), and I don't want to spoil your enjoyment. The wait of years has been worth it. This is an entirely worthy sequel, a fine example of "hard" SF in the adventure pattern. Furthermore, it leaves plenty of room for another to look forward to.

But I do hope we'll see it in this century.

Richard Paul Russo's latest SF crime novel is mean streets, callous megacorps, venal politicians, and ordinary lowlifes in a jam. **Carlucci's Edge** thus mines a hoary tradition, and it suffers a bit because the cop, Lt. Frank Carlucci, doesn't do much to solve the crime, but he's an honorable fellow who won't bury a case just because the mayor says. He is thus the respectable vantage point that permits readers who can't identify with the other characters—bar-scene musicians, petty criminals, drug addicts, self-mutilators, and so on—to enjoy his tale.

What's the crime? Paula Asgard discovers it when she stops after a late gig to visit friend and lover Chick Roberts and finds him dead, with three bullet holes in his face. She dutifully reports the murder. Later, when nothing seems to be happening, she contacts Carlucci, who then learns the mayor has ordered the case buried.

Meanwhile, the mayor's nephew has been murdered too. For awhile, the cops are under pressure to solve this one. But then the mayor personally tells Carlucci to take it easy, the boy was scum, leave it alone.

Carlucci has suspicions, but the solution to the case is developing on the street. Paula has the word that Chick was dealing in contraband, got his hands on something big, and tried to peddle it. There are hints of press-ganging street people as workers for New Hong Kong high in orbit—or perhaps it's body snatching since no one is ever heard from again. There are hints of secret progress on the life-extension front. And then Paula's friend Mixer, looking for helpful info, is taken by Saint Katherine, a member of a group that believes in putting people through "trials" vaguely modeled on those undergone by their namesake saints. Most victims do not survive.

But by a strange fluke, Mixer does. As one result, he learns something more of the mayor's involvement. And when Paula discovers some perplexing documents among Chick's effects, he is in position to figure out what they mean.

Russo's characters succeed in stirring our empathy, but their strangeness is what holds our attention. His mean streets are so mean (the Saints are only part of it) that they too hold the interest better than the plot, which is weakened by Russo's choice to have his murders solved almost entirely by serendipity, with some of the key events seeming to owe much more to authorial convenience than to genuine likelihood. It's too bad, for Russo's point—that honor has a place even on the meanest of streets—deserves better.

Patrick O'Leary's first novel, **Door Number Three,** is a rather strange piece of work that begins with the burning of a time machine, a statement that the narrator's personal time-flow is way out of whack, and a promise of great changes to come. But first, here's how things reached this point: A new client, Laura, enters the office of therapist John Donelly, lapsed Catholic, escapee from a domineering mother, dissatisfied in his relationship with his lover. Laura tells John she had two fathers (no mother), one of them an alien Holock, the other a human abductee. She was raised among the Holocks, and now she has one year to convince a sane human being to believe her story. If she succeeds, she can stay on Earth. If she fails, she must go back to the Holocks and the torments they like to visit upon her. "And yes, John, if you want proof, look at this," at which point she bares her breasts to show him *square* nipples.

It takes neither John nor the reader long to figure out that things are not that simple. Laura lies. Mysterious figures hover in the background, government agents appear, a millionaire mystic explains something of who the Holocks are—our own distant descendants, who feed on our dreams (that's why we don't remember them well)—and what they are up to. Laura's mission, it seems, is to seduce John and take his firstborn back to the Holocks so that it will not prevent their eventual existence. Knowing this, of course, John still succumbs to her wiles.

The time machine is the key to John's eventual victory. It sends him, in a very real-seeming (or "lucid") dream, into the Holocks's world, where he can try to resolve the crisis—which is not his alone; the Holocks pose a threat to all humanity.

I won't say what that threat is or how John resolves it. After all, I have to leave something for you to find in the book. Yet I can point to John's past and profession: Crippled by his mother's expectations and pressures, he nevertheless tries hard to help his clients get at and resolve their own psychological conflicts. He likes Jung, who talked much of archetypes and dreams, and as a therapist himself he represents the "therapeutic program," if you will, that if individuals could be healed the world could be a much, much better place.

Here, I think, is O'Leary's point. In dreams, he says, lie truth and insight and healing, and if we dream lucidly, with awareness and memory and control, we heal ourselves. If everyone does it, the world itself is healed, and we have Utopia. His tale is thus something of a parable—as it had better be, for taken straight, it's just a crock.

Rock of Ages is Walter Jon Williams's latest light novel (he calls them "divertimenti") concerning the adventures of Drake Maijstral, citizen of the far-future culture that grew from the cross-fertilization of Earth by the Khosali Empire. The human-Khosali relationship began when the Khosali conquered humanity. Later rebellion established a separate human empire or Constellation. For some, the separation is still a prickly thing, and the memory of the past is bitter. For others, the Khosalis are still the upper crust, and those who wish to ape their betters have adopted such Khosali gestures as ear-flicking and neck-sniffing, as well as the trappings of an aristocracy that scatters dukes and earls all over the landscape and assiduously adopts local gods into its pantheon (Elvis hasn't made it yet, but He is apparently under serious consideration).

Cultural exchange has also brought humans the notion of High Custom, whereby the aristocracy struts with awesome preciosity for the delectation of the masses (this is *alien* behavior? Then that explains it). Within High Custom is the institution of the Allowed Burglar, who can steal from the rich as long as he does it with style. Drake Maijstral is such an Allowed Burglar; Williams has chronicled his adventures in two previous books, *The Crown Jewels* (reviewed here in the July 1988 column) and *House of Shards*.

In this one, Maijstral is visiting Earth. His reputation precedes him—during a visit to the Louvre, he is surrounded by guards—but he is on vacation. He has no nefarious plans at all.

Still, something disappears from the museum. Later it shows up in his room, as do other purloined objects—including the coffin of his father, complete with querulous corpse. He seems to be the center of a plot aimed at his destruction, and when complications arise in the form of a pair of women who wish to marry him, a rather clumsy would-be burglar, a pair of actors who resent his ignorance of their performances (they act *him*, after all), challenges to duels, the theft of the coffin and its concealment in Graceland, rebuilt after the New Madrid Earthquake as the Intergalactic Church of Elvis, the plot gets a bit tangled.

As before, the flavor is of the Ruritanian romance—complex machinations, preposterous premises, ridiculous characters, posturing heroes, bumbling action. It reminds of P. G. Wodehouse, the Three Stooges, and Gilbert and Sullivan. It's light and diverting and surely Hollywood is missing a bet by not grabbing these novels for movies.

The fourth in Orson Scott Card's Alvin Maker series is now out, seven years after the last one. Since Alvin is the seventh son of a seventh son, the timing may be appropriate, but there are a great many readers, I'm sure, who wish that they hadn't had to wait so long.

Has the wait been worth it? **Alvin Journeyman** picks up Alvin's tale after his apprenticeship, which he ended by stepping into the smithy fire to turn his journeyman piece, an iron plow, into living gold. Now he is with his family in the frontier hamlet of Vigor Church, trying to teach Making and finding it hard going. His brother Calvin, who is sure he is a better Maker than Alvin, wishes nothing more than to destroy and control; he leaves, heading for Europe where he hopes to learn the arts of domination from Napoleon. A maiden dreams of a passionate Alvin and tells the tale as if it were true. Alvin leaves town, going to Hatrack River, the town of his birth and apprenticeship, only to be trapped by a lawsuit and faced with a slavemaster plot to murder him. Much of the novel he spends in jail, awaiting trial, while the Unmaker exploits rivalries and jealousies and hatreds stirred up earlier in the series and attempts to extinguish Alvin.

Alvin's fate cannot be doubted. He has loyal friends, including Peggy Larner, his own true love and teacher and life preserver, and an English lawyer come to find him after meeting Calvin, and they see to it that justice and Making triumph.

What of Calvin? He too gains his ends, and then he returns to North America. The next volume will surely deal in much more depth with him, and perhaps it will end with the reconciliation Peggy says near the beginning of this book is so essential to the future.

Alvin Journeyman is very much a middle volume for the series. It ties off loose ends, brings people and forces together, and sets the stage for a climax which—Card being Card—may yet be more than one volume off. As a novel in its own right, I did not find it very satisfying, perhaps partly because it has been so long since the earlier volumes, perhaps partly because the nature of Making has stepped away from center stage to make room for politics. And political novels are far too common to let Card's talents shine forth as they can when he is telling his own uniquely magical sort of tale.

Katharine Kerr's **Freeze Frames** is a set of four novellas, with trimmings, that fails to convince on one level but succeeds on another. The failure begins in the first novella, "Dr. Lucky," where bored college prof John Wagner is tempted by the devil in the guise of student Nick Harrison. Wagner succumbs, loses years, and becomes a drug-maker and dealer in the Haight-Ashbury of the 1960s. There he falls for Maggie Corey and moves in with her—until she comes to her senses and leaves, though not without first insulting the devil and earning Old Nick's eternal enmity, for her and all her descendants.

The problem here is not with the Haight. Its portrait seems quite reasonable. But Old Nick is another matter. Perhaps fantasy fans can believe in him enough to suspend their disbelief, but I cannot.

The second novella, "The Stargazer," is set in the Sierran hills, where Maggie went to have her child. This is more convincing, for there is no sign of the supernatural here, only a bleak description of a society in trouble born of the exhaustion of fossil fuels. The focus is on Leslie, who is going over her late mother's computer files—top-notch science—and notebooks—full of apparent delusions of telepathic contact with alien Masters and Slaves who are on their way to conquer Earth.

The third novella, "Asylum," centers on Maggie's daughter, Janet, a scholar of note and a defender of those oppressed by a conservative U.S. government. She is in England when a Christian military junta takes over the U.S. and declares her an enemy of the people. Nick Harrison's name appears among those who now rule.

"Resurrection," number four, first appeared as a small book from Bantam and *Pulphouse* (I called it "warm and touching" in the January 1993 column, and it still is). Briefly, it deals with Maggie's great granddaughter Tiffany, an Air Force pilot for a U.S. whose chief export is mercenaries (remember that junta). She survived a near-fatal crash and is now undergoing neural retraining. She is confused by memories of flying a combat mission when the records insist that she was only a transport pilot. But then Nick Harrison and his ancient foe the Rabbi Akiba (whom we now realize has made brief appearances in the earlier tales) appear to tell her that her memories are real, in a parallel world. And she can go back if she wishes. The point of the tale is her realization that if she returns, she will cause pain to all those friends and loved ones who have come to terms with her "death" and to those in this world who would then lose her.

Finally, a short story, "Messengers: AGGELOI," brings the aliens to life, and an envoi shows us an annoyed Nick and a satisfied Akiba.

The cover calls this "Book One of a sweeping family saga," but a novel, it isn't. It lacks unity and cohesion even more than most fix-ups. It is persuasive or convincing only if you close one eye (preferably the one that sees the devil—Heinlein didn't need Old Nick for his ascendant theocracy, and Kerr really does not justify his presence here). Yet there is a great deal here of interest, and the saga may yet prove as popular as Kerr's Deverry series.

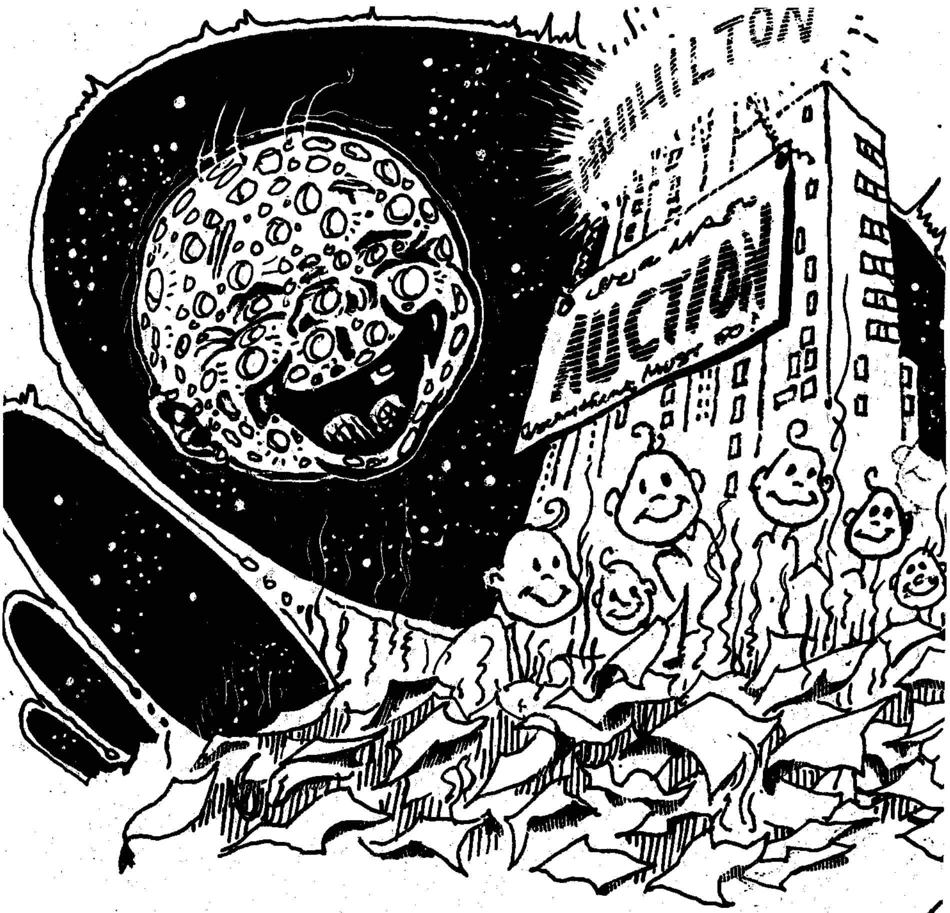
Ursula K. Le Guin's **Four Ways to Forgiveness** is a set of four linked novellas that may be best described as parables of a mode of right living she aphorizes as "hold fast to the one noble thing."

The central setting is the twin planets of Werel and Yeowe. When first contacted by representatives of the Hainish Ekumen, the former, a slave culture, hastily developed space technology, colonized its uninhabited neighbor, and installed there a suite of plantations, logging enterprises, and mines reminiscent of South Africa, Siberia, and the American South. In due time, the slaves rose to throw off their masters, first on Yeowe and then on Werel itself. In both cases, women remained subservient and had a separate war all their own to fight. The issues, tactics, and debates are familiar from our own history; Le Guin brings them so effectively to life that this slim book could be essential reading in a great many high school and college courses.

In the first of the four novellas, "Betrayals," a retired teacher meets a mad, deposed tyrant. They help each other, and the tyrant is the first to express Le Guin's aphorism, as what he failed to do. In the second, "Forgiveness Day," we meet Solly, a young woman serving as a representative of the Ekumen on Werel; she sees firsthand the effect of rigid stratification on the human mind, runs into the rebellion, and acquires a partner who has lived up to the aphorism. "A Man of the People" traces the history of a young man of a village on Hain, a world whose long history has brought up the realization that there is such a thing as "local truth," which can seem quite limited and provincial to a narrow mind; Havzhiva truly learns this universal truth when he reaches Yeowe. Finally, "A Woman's Liberation" follows Rakam, born a slave on Werel, manumitted, enslaved once more by reactionaries, freed by the underground, escaped to free Yeowe, enslaved as a woman, and finally, with the aid of determination, luck, and the Ekumen's Havzhiva, freed to a life of responsibility and independence and the liberation of others.

I am writing this on the morning of the day my daughter, Joellen, will graduate from high school. She has college ahead of her, so she won't face the "real world" for a few years yet, but the end of high school is a very traditional boundary, and I cannot help but think that Le Guin is talking about the world Joellen is about to enter. Despite centuries of struggle to increase human dignity and freedom—and despite a great deal of very real progress on that front—we still use race, creed, ethnic origin, and gender as excuses to abuse, exploit, and enslave each other. In college and later, my daughter must encounter this. Perhaps she will be victimized by it. Perhaps she will help to defeat it, to "hold fast to the one noble thing" and continue the struggle for liberation that is Le Guin's theme, here and in many of her earlier books.

Joellen's family will love her and be proud of her forever and always. If she can contribute in some way to that struggle, the rest of the world will be proud of her too. ■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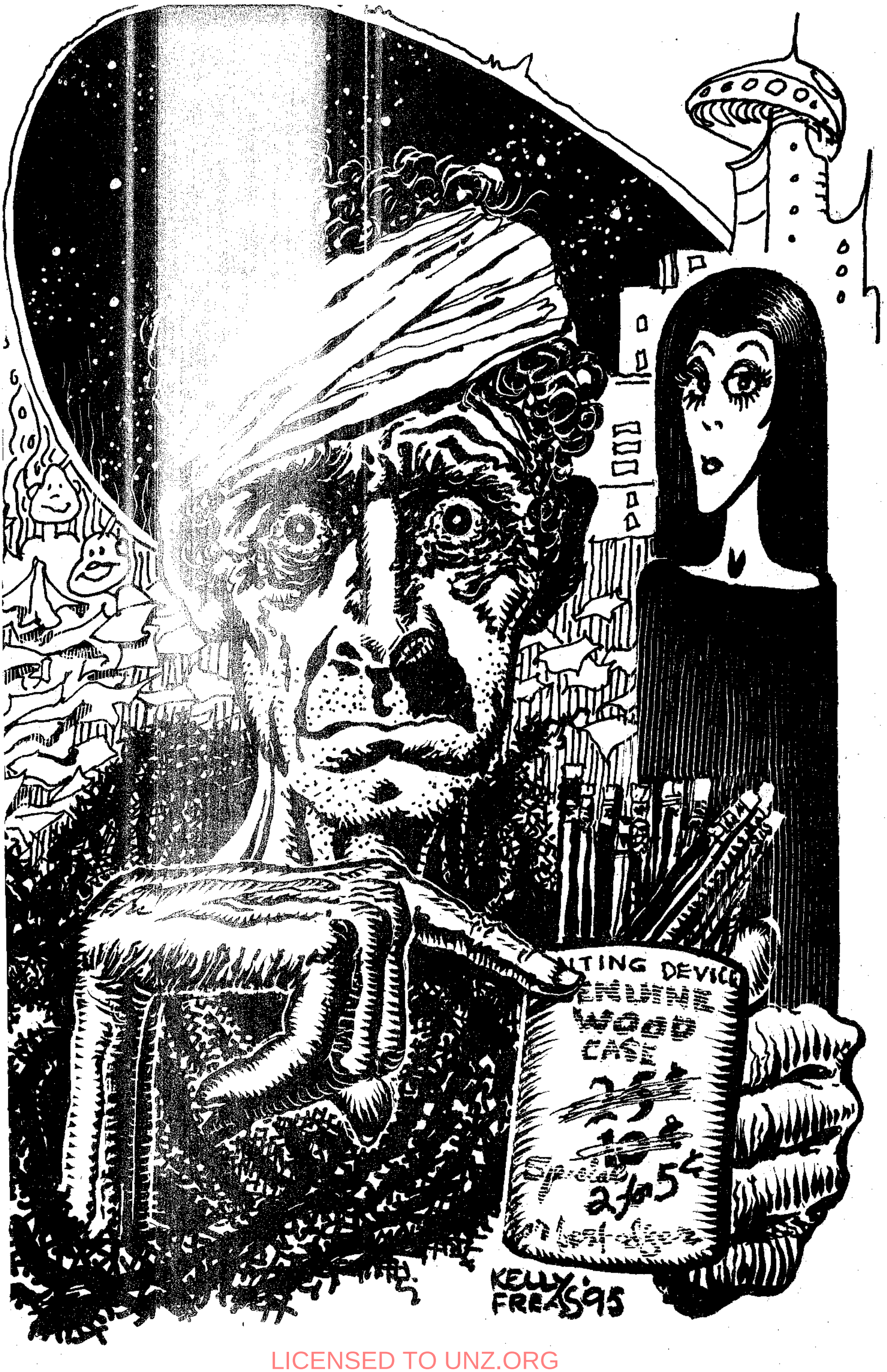
NURSERY SAM

It's not easy running a hotel, and some of the most challenging problems are little ones!

Illustration by Kelly Freas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I was trying to get away from the senator who wanted to marry me. So I'm sitting in the Clipper—riding tourist fare—waiting for the engines to light off and fly us to my zero *g* hotel, when who traipses into the cabin but Jack Spratt and his wife.

With a baby.

I scrunched *way* down in my seat. I didn't want them to see me. I had enough troubles without a pissed-off former employee staring daggers at me for the whole ride up to orbit.

His name wasn't really Jack Spratt, of course. It was Larry Karsh, and he had been a pretty key player in my old company, VCI. But that goddamnable Pierre D'Argent, the silver-haired slimeball, had hired him away from me and Larry wouldn't have gone to work at Rockledge if he hadn't been sore at me for some reason. Damned if I knew what.

OK, maybe I shouldn't have called them the Spratts. But you know, Larry was so skinny he hardly cast a shadow and Melinda was—well, the kindest word is *zaftig*, I guess. She could just look at a potato chip and gain two kilos. Larry could clean out a whole shopping mall's worth of junk food and never put on an ounce. So with him such a classic ectomorph and Melinda so billowy despite every diet in the world, it just seemed natural to call them Jack Spratt and his wife.

I guess it irritated Larry.

Well, I didn't like the idea of bringing a baby up to my zero *g* hotel. Business was lousy enough up there without some mewling, puking ball of dirty diapers getting in everybody's way. Heaven—that was my name for the hotel—was supposed to be for honeymooners. Oh, I'd take tourists of any sort, but I always thought of Heaven as primarily a honeymoon hotel. You know, sex in free-fall; weightless lovemaking.

For the life of me, I couldn't figure out why people didn't flock to Heaven. I thought I had a terrific motto for the hotel: "If you like water beds, you'll love zero g."

OK, OK, so most people got sick their first day or so in weightlessness. It's a little like seasickness: you feel kind of nauseous, like you're coming down with the flu. You feel like you're falling all the time; you want to upchuck and just generally die. Of course, after a while it all goes away and you're floating around in zero *g* and you start to feel terrific. Scientists have even written reports about what they call "microgravity euphoria." It's wonderful!

But first you've got to get over the miseries. And I knew damned well that Rockledge was working on a cure for space sickness, right there in the same space station as my Hotel Heaven. But even if they found the cure, who do you think would be the *last* person in the Solar System that Pierre D'Argent would sell it to?

That's right. Sam Gunn, Esq. Me.

Me, I love weightlessness. God knows I've spent enough time in zero *g*. The idea for the honeymoon hotel came out of plenty of practical experience, believe me. In fact, the senator who wanted to marry me had been one of my first datum points in my research on zero *g* sex, years ago. She had been a fellow astronaut, back in the days when we both worked for the old NASA.

But it only takes a few newlyweds tossing their cookies when free-fall first hits them to sour the whole damned travel industry on the idea of honeymooning in Heaven. As one travel agent from North Carolina told me, sweetly, "Even if you don't get sick yourself, who wants to spend a vacation listening to other people puking?"

I tried beefing up the acoustical insulation in the suites, but Heaven got the reputation of being like an ocean liner that's always in rough seas. And to this day I'm still convinced that D'Argent used Rockledge's high-powered public relations machine to badmouth Heaven. D'Argent hated my guts, and the feeling was mutual.

And now Jack Spratt and his wife are bringing a baby up to Heaven. Perfect.

They sat two rows in front of me: Larry Karsh, Melinda, and a squirming dribbling baby that couldn't have been more than nine or ten months old. Larry had filled out a little in the couple of years since I had last seen him, but he still looked like an emaciated scarecrow. Melinda had slimmed down a trace. Maybe. They still looked like Jack Spratt and his wife. And baby.

I could feel my face wrinkling into the grandfather of all frowns. A baby aboard a space station? That's crazy! It's sabotage! Yet, try as I might, I couldn't think of any company rules or government regulations that prohibited people from bringing babies to Heaven. It just never occurred to me that anybody would. Well, I'll fix *that,* I told myself. What the hell kind of a honeymoon hotel has a baby running around in it? Upchucking is bad enough; we don't need dirty diapers and a squalling brat in orbit. They're going to ruin the whole idea of Heaven.

The Clipper took off normally; we pulled about three *g*s for a minute or so. The cabin was less than half full; plenty of empty seats staring at me like the Ghost of Bankruptcy To Come. I scrunched deeper in my seat so Jack Spratt and his wife wouldn't see me. But I was listening for the yowling that I knew was on its way.

Sure enough, as soon as the engines cut off and we felt weightless, the baby started screaming. The handful of paying passengers all turned toward the kid, and Larry unbuckled himself and drifted out of his seat.

"Hey, T.J., don't holler," he said, in the kind of voice that only an embarrassed father can put out. While he talked, he and Melinda unbuckled the brat from his car seat.

The baby kicked himself free of the last strap and floated up into his father's arms. His yowling stopped. He gurgled. I knew what was coming next: his breakfast.

But instead the kid laughed and waved his chubby little arms. Larry barely touched him, just sort of guided him the way you'd tap a helium-filled balloon.

"See?" he cooed. "It's fun, isn't it?"

The baby laughed. The passengers smiled tolerantly. Me, I was stunned that Jack Spratt had learned how to coo.

Then he spotted me, slumped down so far in my seat I was practically on the floor. And it's not easy to slump in zero *g*; you really have to work at it.

"Sam!" he blurted, surprised. "I didn't know you were on this flight." And Melinda turned around in her chair and gave me a strained smile.

"I didn't know you had a baby," I said, trying not to growl in front of the paying customers.

Larry floated down the aisle to my row, looking so proud of his accomplishment you'd think nobody had ever fathered a son before. "Timothy James Karsh, meet Sam Gunn. Sam, this is T.J."

He glided T.J. in my direction, the baby giggling and flailing both his arms and legs. For just the flash of a second I thought of how much fun it would be to play volleyball with the kid, but instead I just sort of held him like he was a Ming vase or something. I didn't know what the hell to do with a baby!

But the baby knew. He looked me straight in the eye and spurted out a king-sized juicy raspberry, spraying me all over my face. Everybody roared with laughter.

I shoved the kid back to Larry, thinking that baseball might be more fun than volleyball.

In the fifty-eight minutes it took us to go from engine cut-off to docking with the space station, T.J. did about eleven thousand somersaults, seventy-three dozen midair pirouettes, and god knows how many raspberries. Everybody enjoyed the show, at first. The women especially gushed and gabbled and talked baby-talk to the kid. They reached out to hold him, but little T.J. didn't want to be held. He was having a great time floating around the tourist cabin and enjoying weightlessness.

I had feared, in those first few moments, that seeing this little bundle of dribble floating through the cabin would make some of the passengers queasy. I was just starting to tell myself I was wrong when I heard the first retching heave from behind me. It finally caught up with them; the baby's antics had taken their minds off that falling sensation you get when zero *g* first hits you. But now the law of averages took its toll.

One woman. That's all it took. One of those gargling groans and inside of two minutes almost everybody in the cabin is grabbing for their whoopie bags and making miserable noises. I turned up the air vent over my seat to max, but the stench couldn't be avoided. Even Melinda started to look a little green, although Larry was as unaffected as I was and little T.J. thought all the noise was hysterically funny. He threw out raspberries at everybody.

When we finally got docked we needed the station's full medical crew and a fumigation squad to clean out the cabin.

Three couples flatly refused to come aboard Heaven; green as guacamole, they canceled their vacations on the spot, demanded their money back, and rode in misery back to Earth. The other eight couples were all honeymooners. They wouldn't cancel, but they looked pretty damned unhappy.

I went straight from the dock to my cubbyhole of an office in the hotel.

"There's gotta be a way to get rid of that baby," I muttered as I slid my slippered feet into their restraint loops. I tend to talk to myself when I'm upset.

My office was a marvel of zero *g* ergonomic engineering: compact as a fighter plane's cockpit, cozy as a squirrel's nest, with everything I needed at my fingertips, whether it was up over my head or wherever. I scrolled through three hours worth of rules and regulations, insurance, safety, travel rights, even family law. Nothing there that would prevent parents from bringing babies onto a space station.

I was staring bleary-eyed at old maritime law statutes on my display screen, hoping that as owner of the hotel I had the same rights as the captain of a ship and could make unwanted passengers walk the plank. No such luck. Then the phone light blinked. I punched the key and growled, "What?"

A familiar voice said coyly, "Senator Meyers would like the pleasure of your company."

"Jill? Is that you?" I cleared my display screen and punched up the phone image. Sure enough, it was Sen. Jill Meyers (R-NH).

Everybody said that Jill looked enough like me to be my sister. If so, what we did back in our youthful NASA days would have to be called incest. Jill had a pert round face, bright as a new penny, with a scattering of freckles across her button of a nose. OK, so I look kind of like that, too. But her hair is a mousy brown and straight as a plumb line, while mine is on the russet side and curls so tight you can break a comb on it.

Let me get one thing absolutely clear. I am taller than she. Jill is not quite five-foot three, whereas I am five-five, no matter what my detractors claim.

"Where are you?" I asked.

"Roughly fifty meters away from you," she said, grinning.

"Here? In Heaven?" That was not the best news in the world for me. I had come up to my zero *g* hotel to get away from Jill.

See, I had been sort of courting her down in Washington because she's a ranking member of the Senate Commerce Committee and I needed a favor or two from her. She was perfectly happy to do me the favor or two, but she made it clear she was looking for a husband. Jill had been widowed maybe ten years earlier. I had never been married and had no intention of starting now. I like women way too much to marry one of them.

"Yes, I'm here in Heaven," Jill said, with a big grin. "Came up on the same flight you did."

"But I didn't see you."

"Senators ride first class, Sam."

I made a frown. "At the taxpayers' expense."

"In this case, it was at the expense of Rockledge International Corporation. Feel better?"

No, I didn't feel better. Not at all. "Rockledge? How come?"

"I've been invited to inspect their research facilities here at their space station," Jill said. "Pierre D'Argent himself is escorting me."

I growled.

Maybe I should tell you that the Rockledge space station was built of three concentric wheels. The outermost wheel spun around at a rate that gave it the feeling of regular Earth gravity: one *g*. The second wheel, closer to the hub, was at roughly one-third *g*: the gravity level of Mars. The innermost wheel was at one-sixth *g*, same as the Moon. And the hub, of course, was just about zero gravity. The scientists call it microgravity but it's so close to zero *g* that for all intents and purposes you're weightless at the hub.

I had rented half the hub from Rockledge for my Hotel Heaven. Zero *g* for lovers. OK, so it's not exactly zero *g*, so what? I had built thirty lovely little minisuites around the rim of the hub and still had enough room left over to set up a padded gym where you could play anything from volleyball to blind-man's bluff in weightlessness.

Once I realized that most tourists got sick their first day or so in orbit, I tried to rent space down at the outermost wheel, so my customers could stay at normal Earth gravity and visit the zero *g* section when they wanted to play—or try weightless sex. No dice. D'Argent wouldn't rent any of it to me. He claimed Rockledge was using the rest of the station—all of it—for their research labs and their staff. Which was bullcrap.

I did manage to get them to rent me a small section in the innermost wheel, where everything was one-sixth *g*. I set up my restaurant there, so my customers could at least have their meals in some comfort. Called it the Lunar Eclipse. Best damned restaurant off Earth. Also the only one, at that time. Lots of spilled drinks and wine, though. Pouring liquids in low gravity takes some training. We had to work hard to teach our waiters and waitresses how to do it. I personally supervised the waitress training. It was one of the few bright spots in this black hole that was engulfing me.

"How about lunch?" Jill asked me, with a bright happy smile.

"Yeah," I said, feeling trapped. "How about it?"

"What a charming invitation," said Jill. "I'll see you at the restaurant in fifteen minutes."

Now here's the deal. The first big industrial boom in orbit was just starting to take off. Major corporations like Rockledge were beginning to realize that they could make profits from manufacturing in orbit.

They had problems with workers getting space sick, of course, but they weren't as badly affected as I was with Heaven. There's a big difference between losing the first two days of a week-long vacation because you're nauseous and losing the first two days of a ninety-day work contract. Still, Rockledge was searching for a cure. Right there on the same space station as my Hotel Heaven.

Anyway, I figured that the next step in space industrialization would be to start digging up the raw materials for the orbital factories from the Moon and the asteroids. A helluva lot cheaper than hauling them up from Earth, once you get a critical mass of mining equipment in place. The way I saw it, once we could start mining the Moon and some of the near-approach asteroids, the boom in orbital manufacturing would really take off. I'd make zillions!

And I was right, of course, although it didn't exactly develop the way I thought it would.

I wanted to get there first. Start mining the Moon, grab an asteroid or two. Megafortunes awaited the person who could strike those bonanzas.

But the goddamned honeymoon hotel was bleeding me to death. Unless and until somebody came up with a cure for space sickness, Heaven was going to be a financial bottomless pit. I was losing a bundle trying to keep the hotel open, and the day D'Argent became Rockledge's CEO he doubled my rent, sweetheart that he is.

But I knew something that D'Argent didn't want me to know. Rockledge was working on a cure for space sickness. Right here aboard the space station! If I could get my hands on that, my troubles would be over. Pretty much.

It occurred to me, as I headed for the Lunar Eclipse, that maybe Jill could do me still another favor. Maybe her being here on the station might work out OK, after all.

I pushed along the tube that went down to the inner ring. You had to be careful, heading from the hub towards the various rings, because you were effectively going downhill. Flatlanders coming up for the first time could flatten themselves but good if they let themselves drop all the way down to the outermost wheel. The Coriolis force from the station's spin would bang them against the tube's circular wall as they dropped downward. The farther they dropped, the bigger the bangs. You could break bones.

That's why Rockledge's engineers had designed ladder rungs and safety hatches in the tubes that connected the hub to the wheels, so you had something to grab onto and stop your fall. I had even thought about padding the walls but D'Argent nixed my idea: too expensive, he claimed. He'd rather see somebody fracture a leg and sue me.

I was almost at the lunar level. In fact, I was pulling open the hatch when I heard a yell. I look up and a bundle of screaming baby comes tumbling past me like a miniature bowling ball with arms and legs.

"Catch him! Stop him!"

I look around and here comes Larry Karsh, flailing around like a skinny spider on LSD, trying to catch up with his kid.

"Sam! Help!"

If I had thought about it for half a microsecond I would've let the kid bounce off the tube walls until he splattered himself on the next set of hatches. And Larry after him.

But, no—instinct took over and I shot through the hatch and launched myself after the baby like a torpedo on a rescue mission. S. Gunn, intrepid hero.

It was a long fall to the next set of hatches. I could see the kid tumbling around like a twenty-pound meteoroid, his little T-shirt flapping in the breeze, hitting the wall and skidding along it for a moment, then flinging out into midair again. He didn't hit the wall so hard, at first, but each bump down the tube was going to be harder, I knew. If I didn't catch him real fast, he'd get hurt. Bad.

There was nobody else in the damned tube, nobody there to grab him or brake his fall or even slow him down a little.

I started using the ladder rungs to propel myself faster, grabbing the rungs with my fingertips and pushing off them, one after another, faster and faster. Like the Lone Ranger chasing a runaway horse. Damned Coriolis force was getting to me, though, making me kind of dizzy.

As I got closer and closer, I saw that little T.J. wasn't screaming with fear. He was screeching with delight, happy as a little cannonball, kicking his arms and legs and tumbling head over diaper, laughing hard as he could.

Next time he hits the wall he won't be laughing anymore, I thought. Then I wondered if I could reach him before he slammed into the hatch at the bottom of this level of the tube. At the speed I was going I'd come down right on top of him and the kid wouldn't be much of a cushion.

Well, I caught up with him before either of us reached the next hatch, tucked him under one arm like he was a wriggling football, and started trying to slow my fall with the other hand. It wasn't going to work, I saw, so I flipped myself around so I was coming down feet-first and kept grabbing at rungs with my free hand, getting dizzier and dizzier. Felt like my shoulder was going to come off, and my hand got banged up pretty good, but at least we slowed down some.

The baby was crying and struggling to get loose. He'd been having fun, dropping like an accelerating stone. He didn't like being saved. I heard Larry yelling and looked up; he was clambering down the ladder, all skinny arms and legs, jabbering like a demented monkey.

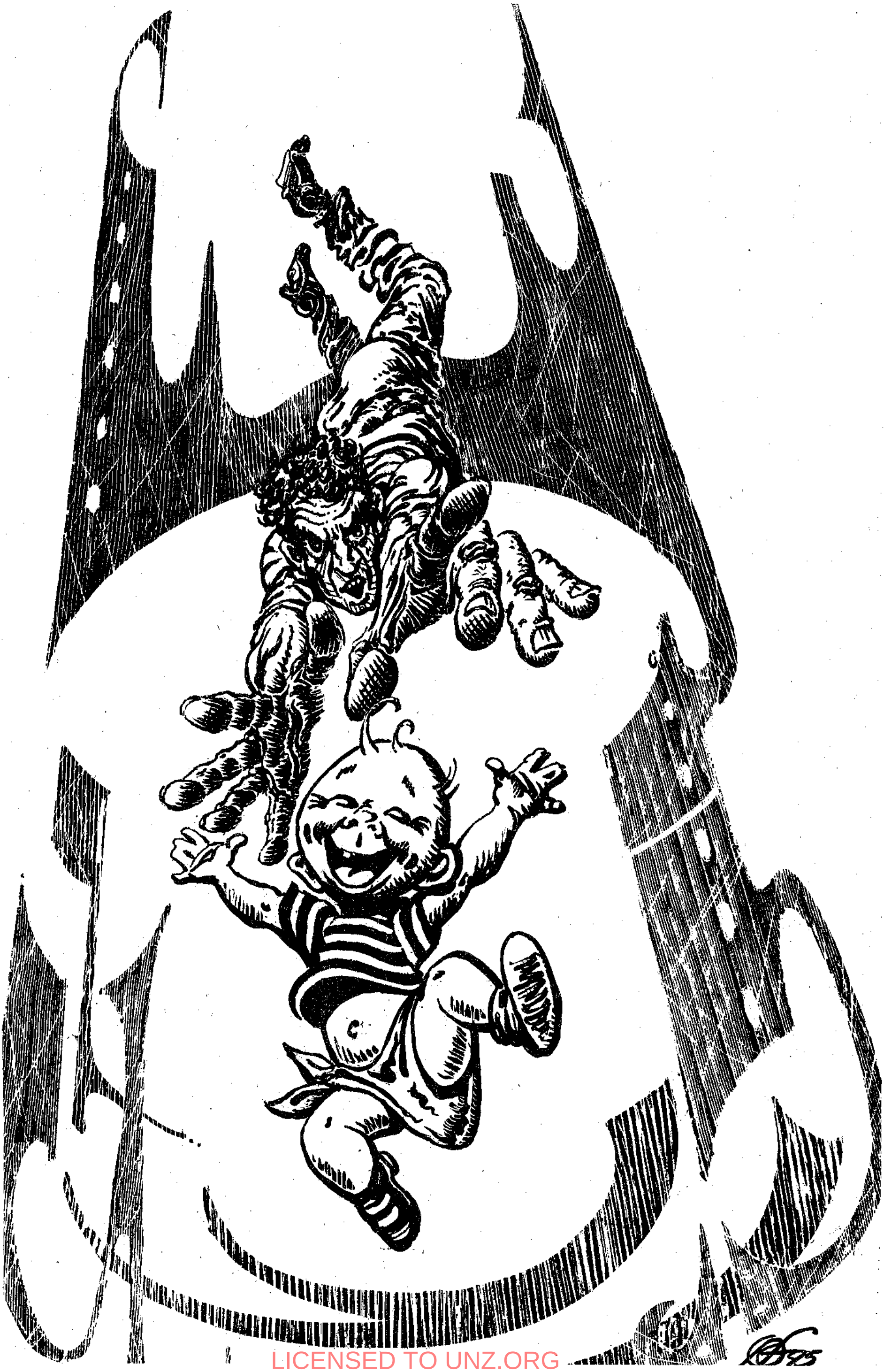
I hit the hatch feet first like I'd been dropped out of an airplane. I mean, I did my share of parachute jumps back when I was in astronaut training, but this time I hit a hell of a lot harder. Like my shinbones were shattering and my knees were trying to ram themselves up into my ribcage. I saw every star in the Milky Way and the wind was knocked out of me for a moment.

So I was sprawled on my back, kind of dazed, with the kid yelling to get loose from me, when Larry comes climbing down the ladder, puffing like *he'd* been trying to save the kid, and takes the yowling little brat in his arms.

"Gee, thanks, Sam," he says. "I was changing his diaper when he got loose from me. Sorry about the mess."

That's when I realized that T.J.'s diaper had been loose and the ungrateful little so-and-so had peed all down the front of my shirt.

So I was late for my lunch date with Senator Meyers. My hand was banged up and swollen, my legs ached, my knees felt like they were going to explode, and the only other shirt I had brought with me was all wrinkled from being jammed into my travel



bag. But at least it was dry. Even so, I got to the restaurant before she did. Jill was one of those women who has a deathly fear of arriving anywhere first.

I was so late, though, that she was only half a minute behind me. I hadn't even started for a table yet; I was still in the restaurant's teeny little foyer, talking with my buddy Omar.

"Am I terribly late?" Jill asked.

I turned at the sound of her voice and, I've got to admit, Jill looked terrific. I mean, she was as plain as vanilla, with hardly any figure at all, but she still looked bright and attractive and, well, I guess the right word is *radiant.* She was wearing a one-piece zipsuit, almost like the coveralls that we used to wear back on the NASA shuttle. But now her suit was made of some kind of shiny stuff and decorated with color accents and jewels. Like Polonius said: rich, not gaudy.

Her hair was a darker shade than I remembered it from the old days, and impeccably coiffed. She was dyeing it, I figured. And getting it done a lot better than she did when she'd been a working astronaut.

"You look like a million dollars," I said as she stepped through the hatch into the restaurant's foyer.

She grinned that freckle-faced grin of hers and said, "It costs almost that much to look like this."

"It's worth it," I said.

Omar, my buddy from years back, was serving as the maitre d' that afternoon. He was the general manager of the hotel, but everybody was pulling double or triple duty, trying to keep the place afloat. He loomed over us, painfully gaunt and tall as a basketball star, his black pate shaved bald, a dense goatee covering his chin. In the easy lunar gravity Omar could walk normally with nothing more than the lightest of braces on his atrophied legs. Omar had more to lose than I did if the hotel went bust. He'd have to go back to Earth and be a cripple.

As he showed us to our table, all dignity and seriousness, Jill cracked, "You're getting gray, Sam."

"Cosmic rays," I snapped back at her. "Not age. I've been in space so much that primary cosmic rays have discolored my pigmentation."

Jill nodded as if she knew better but didn't want to argue about it. The restaurant was almost completely empty. It was the only place aboard the station to eat, unless you were a Rockledge employee and could use their cafeteria, yet still it was a sea of empty tables. I mean, there wasn't any other place for the tourists to eat, it was lunch hour for those who came up from the States, but the Eclipse had that forlorn look. Three tables occupied, seventeen bare. Twelve human waiters standing around with nothing to do but run up my salary costs.

As Omar sat us at the finest table in the Eclipse (why not?) Jill said, "You ought to get some new clothes, Sam. You're frayed at the cuffs, for goodness' sake."

I refrained from telling her about T.J.'s urinary gift. But I gave her the rest of the story about my thrilling rescue, which nobody had witnessed except the butterfingered Jack Spratt.

"My goodness, Sam, you saved that

baby's life," Jill said, positively glowing at me.

"I should've let him go and seen how high he'd bounce when he hit the hatch."

"Sam!"

"In the interest of science," I said.

"Don't be mean."

"He's supposed to be a bouncing baby boy, isn't he?"

She did not laugh.

"Dammit, Jill, they shouldn't have brought a kid up here," I burst out. "It's not right. There ought to be a regulation someplace to prevent idiots from bringing their lousy brats to my hotel!"

Jill was not helpful at all. "Sam," she told me, her expression severe, "we made age discrimination illegal half a century ago."

"This isn't age discrimination," I protested. "That baby isn't a voting citizen."

"He's still a human being who has rights. And so do his parents."

I am not a gloomy guy, but it felt like a big rain cloud had settled over my head. Little T.J. was not the only one pissing on me.

But I had work to do. As long as Jill was here, I tried to make the best of it. I started spinning glorious tales of the coming bonanza in space manufacturing, once we could mine raw materials from the Moon or asteroids.

I never mentioned our weightless escapades, but she knew that I held that trump card. Imagine the fuss the media would make if they discovered that the conservative senator from New Hampshire had once been a wild woman in orbit. With the notorious Sam Gunn, of all people!

"What is it you want, Sam?" Jill asked me. That's one of the things I liked best about her. No bull-hickey. She came straight to the point.

So I did, too. "I'm trying to raise capital for a new venture."

Before I could go any further, she fixed me with a leery eye. "Another new venture? When are you going to stop dashing around after the pot of gold at the end of the rainbow, Sam?"

I gave her a grin. "When I get my hands on the gold."

"Is that what you're after, money? Is that all that you're interested in?"

"Oh no," I said honestly. "What I'm really interested in is the things money can buy."

She frowned; it was part annoyance, part disappointment, I guess. Easy for her. She was born well-off, married even better, and now was a wealthy widowed United States Senator. Me, I was an orphan at birth, raised by strangers. I've always had to claw and scrabble and kick and bite my way to wherever I had to go. There was nobody around to help me. Only me, all five foot three—excuse me, five foot five inches of me. All by myself. You're damned right money means a lot to me. Most of all, it means respect. Like that old ballplayer said, the home-run hitters drive the Cadillacs. I also noticed, very early in life, that they also get the best-looking women.

"OK," I back-peddled. "So money can't buy happiness. But neither can poverty. I want to get filthy rich. Is there anything wrong with that?"

Despite her New England upbringing, a faint smile teased at the corners of Jill's mouth. "No, I suppose not," she said softly.

So I went into the details about my hopes for lunar mining and asteroid prospecting. Jill listened quietly; attentively, I thought, until I finished my pitch.

She toyed with her wine glass as she said, "Mining the Moon. Capturing asteroids. All that's a long way off, Sam."

"It's a lot closer than most people realize," I replied, in my best-behaved, serious man of business attitude. Then I added, "It's not as far in the future as our own space shuttle missions are in the past."

Jill sighed, then grinned maliciously. "You always were a little bastard, weren't you?"

I grinned back at her. "What's the accident of my birth got to do with it?"

She put the wine glass down and hunched closer to me. "Just what are you after, Sam, specifically?" I think she was enjoying the challenge of dealing with me.

I answered, "I want to make sure that the big guys like Rockledge and Yamagata don't slit my throat."

"How can I help you do that?"

"You're on the commerce committee and the foreign relations committee, right? I need to be able to assure my investors that the Senate won't let my teeny little company be squashed flat by the big guys."

"Your investors? Like who?"

I refused to be rattled by her question. "I'll find investors," I said firmly, "once you level the playing field for me."

Leaning back in her chair, she said slowly, "You want me to use my influence as a United States Senator to warn Rockledge and the others not to muscle you."

I nodded.

Jill thought about it for a few silent moments, then she asked, "And what's in it for me?"

Good old straight-from-the-shoulder Jill. "Why," I said, "you get the satisfaction of helping an old friend to succeed in a daring new venture that will bring the United States back to the forefront of space industrialization."

She gave me a look that told me that wasn't the answer she had wanted to hear. But before I could say anything more, she muttered, "That might win six or seven votes in New Hampshire, I guess."

"Sure," I said. "You'll be a big hero with your constituents, helping the little guy against the big, bad corporations."

"Cut the serenade, Sam," she snapped. "You've got something else going on in that twisted little brain of yours; I can tell. What is it?"

She was still grinning as she said it, so I admitted, "Well, there's a rumor that Rockledge is developing an anti-nausea remedy that'll stop space sickness. It could mean a lot for my hotel."

"I hear your zero *g* sex palace is on its way to bankruptcy."

"Not if Rockledge will sell me a cure for the weightless whoopies."

"You think they'd try to keep it from you?"

"Do vultures eat meat?"

She laughed and started in on her plate of soyburger.

After lunch I took Jill down to her

minisuite in the hub and asked how she liked her accommodations.

"Well," she said, drawing the word out, "it's better than the old shuttle mid-deck, I suppose."

"You suppose?" I was shocked. "Each one of Heaven's rooms is a luxurious, self-contained minisuite." I quoted from our publicity brochure.

Jill said nothing until I found her door and opened it for her, with a flourish.

"Kind of small, don't you think?" she said.

"Nobody's complained about the size," I replied. Then I showed her the controls that operated the minibar, the built-in sauna, the massage equipment, and the screen that covered the observation port.

"A real love nest," Jill said.

"That's the idea."

I opened the observation port's screen and we saw the Earth hanging out there, huge and blue and sparkling. Then it slid past as the station revolved and we were looking at diamond-hard stars set against the velvet black of space. It was gorgeous, absolutely breathtaking.

And then we heard somebody vomiting in the next compartment. The hotel's less than one-quarter full and my crack-brained staff books two zero g compartments next to one another!

But Jill just laughed. "This hotel isn't going to prosper until somebody comes up with a cure for space sickness."

"That's what Rockledge is doing," I grumbled. "Right aboard this station."

"You're sure?"

"I'm sure."

Jill pursed her lips. Then, "Let me ask D'Argent about that. Unofficially, of course. But maybe I can find out something for you."

My eyes must have widened. "You'd do that for me?"

Jill touched my cheek with cool fingertips. "Of course I would, Sam. You have no idea of the things I'd do for you, if you'd only let me."

That sounded dangerous to me. So I bid her a hasty adieu and pushed through her doorway, heading for my cubbyhole of an office. Jill just gave me a sphinxlike inscrutable smile as I floated out of her compartment.

When I got back to my office there was more depressing news on my computer screen. A contingent of Rockledge board members and junior executives were scheduled for a tour of the station and its facilities. They would be staying for a week and had booked space in my hotel—at the discount prices Rockledge commanded as my landlord. Those prices, negotiated before I had ever opened Heaven, were lower than the rent D'Argent was now charging me. If I filled the hotel with Rockledge people I could go bankrupt even faster than I was.

And they were all bringing their wives. And children! Larry, Melinda, and their bouncing baby boy were just the first wave of the invasion of the weightless brats. I began to think about suicide. Or murder.

I can't describe the horrors of that week. By actual count there were only twenty-two kids. The oldest was fifteen and the youngest was little T.J., ten months or so. But it seemed like there were hundreds of them, thousands. Everywhere I turned there were brats getting in my way, poking around the observation center; getting themselves stuck in hatches; playing tag along the tubes that connected the station's hub with its various wheels; yelling, screaming; tumbling; fighting; throwing food around; and just generally making my life miserable.

Not only my life. Even the honeymooners started checking out early, with howls of protest at the invasion of the underage monsters and dire threats about lawsuits.

"You'll pay for ruining our honeymoon," was the kindest farewell statement any of them made.

The brats took over the zero *g* gym. It looked like one of those old martial arts films in there, only in weightlessness. They were swarming all over the padded gym, kicking, thrashing, screaming, arms and legs everyplace, howls and yelps and laughing and crying. One five-year-old girl, in particular, had a shriek that could cleave limestone.

I tried to get the three teenagers among them to serve as guardians—guards, really—for the younger tots. I offered them damned good money to look after the brats. The two girls agreed with no trouble. The one boy—fourteen, sullen, face full of zits—refused. He was the son of one of the board members. "My mother didn't bring me up here to be a babysitter," he growled.

As far as I could see, the only thing the pizza-faced jerk did was hang around the hub weightlessly and sulk.

I couldn't blame the honeymooners for leaving. Who wants to fight your way through a screaming horde of little monsters to get to your zero *g* love nest? It was hopeless. I could see D'Argent smiling that oily smile of his; he knew I was going down in flames and he was enjoying every minute of it.

And right in the middle of it were Larry and Melinda and their bouncing baby boy—who really did bounce around a lot off the padded walls of the gym. T.J. loved it in there, especially with all the other kids to keep him company. The two teenaged girls made him their living doll. And T.J. seemed to look out with his ten-month-old eyes at the whole noisy, noisome gang of kids as if they were his personal play-toys, a swirling, riotous, colorful mobile made up of twenty-two raucous, runny-nosed, rotten kids.

Make that twenty-one kids and one fourteen-year-old moper.

I found that Larry and Melinda started feeding the baby in the gym. "It's easier than doing it in the restaurant or in our own quarters," Melinda said, as T.J. gummed away at some pulpy baby goop. "Practically no mess at all."

I could see what she meant. They just hovered in midair with the baby. Three-fourths of what they aimed at the brat's mouth wound up in his ear or smeared over his face or spit into the air. Being weightless, most of the stuff just broke into droplets or crumbs and drifted along in the air currents until they stuck on one of the intake ventilator screens. At the end of the meal Larry would break out a hand vacuum and clean off the screens while Melinda cleaned the baby with premoistened towels. Not bad, I had to admit. Didn't have to mop the floor or clean any furniture.

The other kids liked to eat in zero *g*, too. Made their food fights more interesting. It was OK with me; anything that kept them out of the restaurant or the other areas where adult human beings lived and worked was a score for our side, far as I was concerned. But zero *g* sex was a thing of the past as long as they held the station's gym in their grubby little paws. My honeymoon hotel had turned into an orbital camp for tots.

"You were right, Sam," Jill told me over dinner the third or fourth night of Hell Week.

The restaurant was almost empty. Nearly every one of Rockledge's junior executives took their meals in their rooms. Too cheap for the restaurant, they used the fast-food dispensers and the cafeteria in the Rockledge research facility.

At least the Eclipse was quiet. No kids. I had thought about trying to make a rule that nobody under twenty-one was allowed into the Lunar Eclipse, but Omar, my long-suffering hotel manager, had convinced me that it would just cause a ruckus with the parents. They were happy as Torquemada in a synagogue to be in the restaurant without their little darlings. But if I said they weren't allowed to bring their kids to the Eclipse they'd get pissed off and *demand* their rights.

So the restaurant was nice and quiet and civilized with all the kids up in the gym dashing around and playing zero *g* games.

"I was right about what?" I asked. I must have looked as miserable as I felt. My mind was echoing with the screeches of all those brats yowling at the top of their lungs and the somber prediction of my accountant that the hotel would sink beneath the financial waves in another two weeks. All day long I had been receiving cancellation notices from travel agencies. The word was going around at the speed of light.

Jill nudged her chair a little closer to mine. "Rockledge really is working on a preventative for space sickness. Pierre D'Argent showed me the laboratory studies they've done so far. It looks as if they've got it."

No sooner had she mentioned D'Argent's name than the silver-haired sonofabitch showed up at the restaurant's door, leading a contingent of six senior Rockledge board members and their trophy wives. The men all looked like grumpy old farts, white-haired or bald; the women were heavy with jewelry. I wondered which one of them owned that fourteen-year-old sourpuss.

"What lovely women," Jill said.

I made no response.

"Don't you think they're beautiful, Sam?"

I grunted. "Who cares."

Jill gave me a funny expression. I didn't realize it at the time, but her expression was a mixture of surprise and admiration. She thought I had finally matured to the point where I didn't salivate like one of Pavlov's dogs every time I saw a good-looking woman. What Jill didn't realize was that I was too down in the dumps to be interested in a bevy of expensively-dressed advertisements for cosmetic surgery who were already married. I never chased married women. Never. That's a point of honor with me. It also saves you a lot of threats, fights, law suits, and attempts on your life.

Jill returned to her original subject. "Didn't you hear me, Sam? Rockledge is going to market a skin patch that prevents space sickness."

"Yeah," I said gloomily. "The day after this hotel closes, that's when they'll put it on the market."

I was watching D'Argent and his troupe as they sat at the biggest table in the restaurant. Laughing softly among themselves, happy, relaxed, their biggest worry was how to evade the taxes that were due on their enormous profits. The more they ate and drank, at their discount prices, the deeper into the red they pushed me.

Jill shook me by my wrist and made me look at her. She had a kind of pixie grin on her face. Almost evil. "Suppose I could get D'Argent to use your hotel customers as a field trial for their new drug?"

"Suppose you could get the Pope to pee off the roof of the Vatican."

"Wouldn't that help you?" she insisted.

I had to admit that it might.

"Then that's what I'll do," Jill said, as firmly as a US Senator announcing she was running for reelection.

I had no romantic interest in Jill, and for the life of me I couldn't figure out why she was interested in me. What did it matter? I was in such a funk over those brats infesting my hotel that I wouldn't have noticed if Helen of Troy had been sitting naked in my bed with her arms out to me. Well, maybe.

What was going through my mind was an endless vicious circle. The hotel is failing. When the hotel goes down the tubes it'll drag my company, VCI, down with it. VCI was technically in the black, making steady money selling magnetic bumpers that protected space facilities from orbiting debris. But legally, VCI owned Hotel Heaven and the hotel's accumulated debts would force VCI into bankruptcy. I would be broke. Nobody would lend me a cent. There went my dreams for mining the Moon and making myself the tycoon of the asteroids. I'd have to find a job someplace.

Unless—there was only one way I could see out of the black pit that was staring at me. I had to swallow hard several times before I could work up the nerve to even put out a feeler. But it was either that or bankruptcy, the end of all my dreams. So the next morning I gritted my teeth (having swallowed hard several times) and took the first little step on the road to humiliation.

"Hi, Larry old pal, how's it going?" The words almost stuck in my throat, but I had to get started somehow.

Oh, that's right, I haven't told you about Larry and Melinda and the Gunn Shield. Here's the story.

I had first started VCI, years earlier, to build magnetic bumpers for space stations, to protect them against the orbiting junk whizzing around up there. Larry designed them for me. They're called Gunn Shields, of course. Without them, a space station would get dinged constantly from the crap zipping around in orbit. Even a chip of paint hits with the impact of a high-power bullet, and there's a helluva lot more than paint chips flying around in the low orbits.

The Russians finally had to abandon their original *Mir* space station because it was starting to look like a target in a shooting gallery. And the more stations and factories people built in orbit, the more debris they created and the more they needed Gunn Shields. A nice, steady, growing market. Not spectacular, not enough to bring in the kind of cash flow I needed, but dependable.

Back in those days Melinda had a crush on me. Just a kid's crush, that's all it was, but Larry loved her madly and hated me for it. She was kind of pretty underneath her avoirdupois, but not my type.

That surprises you? You heard that Sam Gunn chases all types of women, didn't you. No discrimination at all. Well, that's about as true as all the rest of the bull manure they spread about me.

Melinda was not my type. But she had this thing about me and Larry had his heart set on her. So I hired Melinda to come to work for me at VCI, and then kind of offhand asked Larry if he'd like to come along too. Larry was the guy I needed, the one I had to have if VCI was going to be a success. He was the semi-genius who thought up the idea for magnetic bumpers in the first place. Poor fish rose to the bait without even stopping to think. They both moved to Florida and together we put VCI into business.

So while Larry was designing the original bumper, I was touting Melinda off me and onto Larry. Cyrano de Gunn, that's me. Made her fall in love with him. Voila. Once we tested the original bumper and it worked, I got it patented and Larry got Melinda to marry him. Everybody was happy, I thought. Wrong!

For some unfathomable reason, Larry got pissed at me and went off to work for D'Argent, the sneaky sleazoid, over at Rockledge. And when he quit VCI, Melinda did, too.

Oh, yeah, we almost got into a shooting war over the rights to the geocentric orbit. But that's another story. Larry only played a minor role in that one.

Anyway, I had spent a sleepless night tussling over my problems and couldn't see a way out. Except to sell the goddamned hotel to Rockledge. And the rights to the Gunn Shield, too. Dump it all for cash. D'Argent had tried before to sneak the magnetic bumper design away from me. He had tried bribery and even theft. Hell, he had hired Larry with the idea of getting the kid to figure out a way to break my patent. I knew that, even if Larry himself didn't.

So now I toadied up to Larry, in the middle of the mayhem of the station's gym. The kids had taken it over completely. Larry and I were the only adults among the yowling, zooming, screeching, barfing little darlings. Even the two teenaged girls who were supposed to be watching the kids were busy playing free-fall tag and screaming at the top of their considerable voices.

Larry gave me a guarded look. He was feeding T.J., who was happily spraying most of his food in weightless droplets that hovered around him like tiny spheres of multi-colored glop before drifting slowly toward the nearest ventilator grid.

"Where's Melinda?" I asked, trying to radiate good cheer and sincerity while dodging the goo that the baby was spewing out.

"She's down in the second wheel, doing aerobics," he said. He spooned a bit of puke-colored paste out of a jar and stuck it in front of T.J.'s face. The baby siphoned it off with a big slurping noise and even managed to get some of it past his two visible teeth and into his mouth.

Gradually, with every ounce of self-control and patient misdirection I could muster, I edged the topic of conversation to the Gunn Shields. All the time we were both dodging flying kids and the various missiles they were throwing at each other, as well as T.J.'s pretty constant spray of food particles. And I had to shout to make myself heard over the noise the brats were making.

I only hoped that none of them figured out the combinations for the electronic locks on the zero *g* minisuites. I could just see the little SOBs breaking into the minibars and throwing bottles all over the place or scalding themselves in the saunas. Come to think of it, boiling a couple of them might have been fun.

But I had work to do.

The more I talked to Larry about the magnetic shields, though, the more he seemed to drift away from me. I mean, literally move away. He kept floating backward through the big, padded zero *g* compartment and I kept pushing toward him. We slowly crossed the entire gym, with all those kids whooping and zooming around us. Finally I had him pinned against one of the padded walls, T.J. floating upside-down above him and the jar of baby food hovering between us. It was only then that I realized Larry was getting red in the face.

"What's the matter?" I asked, earnestly. "Are you getting sick?"

"Dammit, Sam, they shouldn't be called Gunn Shields!" Larry burst out. "I designed the bumpers, not you! They ought to be called Karsh Shields!"

I was stunned. I had never even thought of that. And he certainly had never mentioned it to me before.

"You mean, all this time you've been sore at me over a public relations title?"

"It means a lot to me," he said, as surly as that teenaged grump.

"Is that why you left me for Rockledge?"

Larry nodded petulantly.

It was my big chance. Maybe my only chance. I let my head droop as if I had suddenly discovered religion and was ashamed of my past life.

"Gee, Larry," I said, just loudly enough to be heard over the screams of the kids, "I never realized how much it meant to you."

"Well, it's my invention but you took out the patent and you took all the credit, too."

I noticed that he had not spoken a word about money. Not a syllable. Larry was pure of heart, bless his unblemished soul.

I looked him in the eye with the most contrite expression I could manage. It was hard to keep from giggling; this was going to be like plucking apples off a blind man's fruit stand.

"If that's the way you feel about it, kid," I said, trying to keep up the hang-dog expression, "then we'll change the name. Look—I—I'll even license Rockledge to manufacture and sell the shields. That's right! Let Rockledge take it over completely! Then you can call them Karsh Shields with no trouble at all!"

His eyes goggled. "You'd do that for me, Sam?"

I slid an arm around his shoulder. "Sure I would. I never wanted to hurt you, Larry. If only you had told me sooner. . . ." I let my voice fade away. Then I nodded, as if I had been struggling inside myself. "I'll sell Rockledge the hotel, too."

"No!" Larry gasped. "Not your hotel."

"I know D'Argent wants it." That wasn't exactly the truth. But I had a strong suspicion the silver-haired bastard would be happy to take the hotel away from me—as long as he thought it would break my heart to part with it.

Larry's face turned red again, but this time he looked embarrassed, not angry. "Sam . . ." He hesitated, then went on, "Look, Sam, I'm not supposed to tell you this, but the company's been working on a cure for space sickness."

I blinked at him, trying to generate a tear or two. "Really?"

"If it works, it should help to make your hotel a success."

"If it works," I said, with a big sigh.

The way I had it figured, Rockledge would pay a nice royalty for the license to manufacture and sell the magnetic bumpers. Not as much as VCI was making in profits from the shields, but the Rockledge royalties would go to me, personally, as the patent-holder. Not to VCI. The damned hotel's debts wouldn't touch the royalties. VCI would go down the tubes, but what the hell, that's business. I'd be moving on to lunar mining and asteroid hunting. ET Resources, Inc. That's what I would call my new company.

Let Larry call them Karsh Shields, I didn't give a fart's worth about that. Let D'Argent do everything he could to make the world forget I had anything to do with them, as long as he sent me the royalty checks on time. What I really wanted, what I desperately needed, was the money to start moving on ET Resources, Inc.

"Maybe I can talk D'Argent into letting you use their new drug," Larry suggested. "You know, try it out on your hotel customers."

I brightened up a little. "Gee," I said, "that would be nice. If only I could keep my hotel." I sighed again, heavier, heavy enough to nudge me slightly away from Larry and the baby. "It would break my heart to part with Heaven."

Larry gaped at me while T.J. stuck a sticky finger in his father's ear.

"It would make both of us happy," I went on. "I could keep the hotel and Rockledge could take over the magnetic bumpers and call them Karsh

Shields."

That really turned him on. "I'll go find D'Argent right now!" Larry said, all enthusiasm. "Would you mind looking after T.J. for a couple of minutes?"

And he was off like a shot before I could say a word, out across the mayhem of all those brats flinging themselves around the gym. Just before he disappeared through the main hatch he yelled back at me, "Oh, yeah, T.J.'s going to need a change. You know how to change a diaper, don't you?"

He ducked through the hatch before I could answer. The kids swarmed all through the place and little T.J. stared after his disappearing father.

I was kind of stunned. I wasn't a baby-sitter! But there I was, hanging in midair with twenty crazed kids zipping all around me and a ten-month-old baby hanging a couple of feet before my eyes, his chin and cheeks smeared with baby food and this weird expression on his face.

"Well," I said to myself, "what the hell do I do now?"

T.J. broke into a bawling cry. He wanted his father, not this stranger. I didn't know what to do. I tried talking to him, tried holding him, even tried making faces at him. He didn't understand a word I said, of course; when I tried to hold him he squirmed and shrieked so loud even the other kids stopped their games to stare at me accusingly. And when I made a few faces at him he just screamed even louder.

Then I smelled something. His diaper.

One of the teenaged girls gave me a nasty look and said firmly, "I'm going to call his mother!"

"Never mind," I said. "I'll bring the kid to her myself."

I nudged squalling T.J. weightlessly toward the hatch and started the two of us down the connector tube toward the second-level wheel, where the Rockledge gym was. It had been a stroke of genius (mine) to put their exercise facility in the wheel that rotated at about one-third *g*, the gravity you'd feel on Mars. You can lift three times the weight you'd be able to handle on Earth and feel like you've accomplished something without straining yourself. But do you think D'Argent or any of his Rockledge minions would give me credit for the idea? When hell freezes over—maybe.

T.J. stopped yowling once I got his flailing little body through the hatch and into the tube. This was a different-enough place for his curiosity to override the idea that his father had abandoned him and whatever discomfort his loaded diaper might be causing him. He was fascinated with the blinking lights on the hatch control panel. I opened and shut the damned hatch half a dozen times, just to quiet him down. Then I showed him the color-coded guide lines on the tube's walls, and the glowing light strips. He pointed and smiled. Kind of a goofy smile, with just two teeth to show. But it was better than crying.

By the time we reached the second wheel we were almost pals. I let him smear his greasy little hands over the hatch control panel; like I said, he liked to watch the lights blink and there wasn't much damage he could do to the panel except make it sticky. I even held his hand and let him touch the keypads that operated the hatch. He laughed when it started to swing open. After we went through he pointed at the control panel on the other side and made it clear he wanted to play with that one, too.

There was enough of a feeling of gravity down at this level for me to walk on the floor, with T.J. crawling along beside me. I tried to pick him up and carry him, despite his smell, but he was too independent for that. He wanted to be on his own.

Kind of reminded me of me.

Melinda was sweaty and puffing and not an ounce lighter than she had been when she entered the exercise room. T.J. spotted her in the middle of all the straining, groaning women doing their aerobics to the latest top-forty pop tunes. He let out a squeal and all the women stopped their workout to surround the kid with cooing gushing baby talk. Melinda was queen of them all, the mother of the center of their attention. You'd think the brat had produced ice cream.

I beat a hasty retreat, happy to be rid of the kid. Although, I've got to admit, little T.J. was kind of fun to be with. When he wasn't crying. And if you held your breath.

True to his naïve word, Larry arranged a meeting between D'Argent and me that very afternoon. I was invited to the section of the station where Rockledge had its lab, up in the lunar wheel, alongside my restaurant.

You might have thought we were trying to penetrate a top-secret military base. Between the Lunar Eclipse and the hatch to the Rockledge Laboratory was a corridor no more than ten meters long. Rockledge had packed six uniformed security guards, an x-ray scanner, three video cameras and a set of chemical sniffers into those ten meters. If we didn't have a regulation against animals they would have probably had a few Dobermans in there, too.

"What're you guys doing in here?" I asked D'Argent, once they had let me through the security screen and ushered me into the compartment he was using as an office. "You've got more security out there than a rock star visiting the Emperor of Japan."

D'Argent never wore coveralls or fatigues, like the rest of us. He was in a spiffy silk suit, pearl gray with pencil-thin darker stripes, just like he wore Earth-side. He gave me one of his oily little smiles. "We need all that security, Sam," he said, "to keep people like you from stealing our ideas."

I sat at the spindly little chair in front of his desk and gave him a sour look. "The day you have an idea worth stealing, the Moon will turn into green cheese."

He glared at me. Larry, sitting at the side of D'Argent's desk, tried to cool things off. "We're here to discuss a business deal, not exchange insults."

I looked at him with new respect. Larry wasn't a kid anymore. He was starting to turn into a businessman. "OK," I said. "You're right. I'm here to offer a trade."

D'Argent stroked his pencil-thin moustache with a manicured finger. "A trade?"

Nodding, I said, "I'll license Rockledge to manufacture and market the magnetic bumpers. You let me buy your space-sickness cure."

D'Argent reached for the carafe on his desk. Stalling for time, I thought. He poured himself a glass of water, never offering any to Larry or me. In the soft lunar gravity of the inner wheel, the water poured at a gentler angle than it would on Earth. D'Argent managed to get most of the water into his glass; only a few drops messed up his desk.

He pretended not to notice it. "What makes you think we've developed a cure for space sickness?" And he gave Larry a cold eye.

"Senator Meyers told me," I said calmly. D'Argent looked surprised. "Jill and I are old friends. Didn't you know?"

"You and Senator Meyers?" I could read the expression on his face. A new factor had entered his calculations.

We went around and around for hours. D'Argent was playing it crafty. He wanted the magnetic bumper business, that was clear to see. And Larry was positively avid to call them Karsh Shields. I pretended that I wanted the space-sickness cure to save my hotel, while all the time I was trying to maneuver D'Argent into buying Heaven and taking it off my hands.

But he was smarter than that. He knew that he didn't have to buy the hotel; it was going to sink of its own weight. In another two weeks I'd be in bankruptcy court.

So he blandly kept insisting that, "The space-sickness cure isn't ready for public use, Sam. It's still in the experimental stage."

I could see from the embarrassed red of Larry's face that it was a gigantic lie.

"Well then," I suggested, "let me use it on my hotel customers as a field trial. I'll get them to sign waivers, take you off the hook, legally."

But D'Argent just made helpless fluttering gestures and talked about the Food and Drug Administration, this law, that regulation, scientific studies, legal red tape, and enough bull crap to cover Iowa six feet deep.

He was stalling, waiting for my hotel to collapse so he could swoop in, grab Heaven away from me, and get the magnetic bumper business at a bargain.

But while he talked in circles, I started to think. What if I could get my hands on his space-sickness cure and try it out on a few of my customers? What if I steal the damned cure right out from under D'Argent's snooty nose and then get a tame chemist or two to reproduce whatever combination of drugs they've got in their cure? That would put me in a better bargaining position, at least. And it would drive the smooth-talking sonofabitch crazy!

So I decided to steal it.

It was no big deal. D'Argent and his Rockledge security types were too Earthbound in their attitudes. They thought that by guarding the corridor access to the laboratory area they had the lab adequately protected. But there were four emergency airlocks strung along that wheel of the station. Two of them opened onto the restaurant; the other two opened directly into the Rockledge research laboratory.

All I had to do was wait until night, get into a spacesuit, and go EVA to one of those airlocks. I'd be inside the lab within minutes and the guards out in the corridor would never know it.

Then I had a truly wicked idea. A diversion that would guarantee that the Rockledge security troops would be busy doing something else instead of guarding the access to their lab.

The meeting with D'Argent ran out of steam with neither one of us making any real effort to meet the other halfway. Halfway? Hell, neither D'Argent nor I budged an inch. Larry looked miserably unhappy when we finally decided to call it quits. He saw his Karsh Shield immortality sliding away from him.

I went straight from D'Argent's office to the station's gym. Nothing had changed there, except that T.J. was gone. The place still looked like a perpetual-motion demonstration, kids flapping and yelling everywhere. All except that surly teenaged boy.

I glided over to him.

"Hi!" I said brightly.

He mumbled something.

"You don't seem to be having a good time," I said.

"So what?" he said sourly.

I made a shrug. "Seems a shame to be up here and not enjoying it."

"What's to enjoy?" he grumbled. "My mother says I have to stay here with all these brats and not get in anybody's way."

"Gee, that's a shame," I said. "There's a lot of really neat stuff to see. You want a tour of the place?"

For the first time his face brightened slightly. "You mean, like the command center and all?"

"Sure. Why not?"

"They threw me out of there when I tried to look in, a couple days ago."

"Don't worry about it," I assured him. "I'll get you in with no trouble."

Sliding an arm across his skinny shoulders as we headed for the command center, I asked him, "What's your name, anyway, son?"

"Pete," he said.

"Stick with me, Pete, and you'll see stuff that hardly any of the adults ever see."

So I took him on a tour of the station. I spent the whole damned afternoon with Pete, taking him all over the station. I showed him everything from the command center to my private office. While we were in the command center I booted up the station security program and found that Rockledge didn't even have intruder alarms or motion sensors inside their lab area. Breaking in through the airlock was going to be easy.

It would have been nifty if I could've used Pete as an excuse to waltz through the Rockledge lab, just to get a look at the layout, but it was off-limits, of course. Besides, Pete grandly informed me that he had already seen them. "Just a bunch of little compartments with all kinds of weird glass stuff in them," he said.

He wasn't such a bad kid, it turned out. Just neglected by his parents, who had dragged him up here, shown off Daddy's place of work, and then dumped him with the other brats. Like any reasonable youth, he wanted to be an astronaut. When he learned that I had been one, he started to look up to me, at least a little bit. Well, actually he was a teeny bit taller than I, but you know what I mean.

We had a great time in one of the escape pods. I sat Pete at the little control panel and he played astronaut for more than an hour. It only took a teeny bit of persuasion to get him to agree to what I wanted him to do. He even liked the idea. "It'll be like being a real astronaut, won't it?" he enthused.

"Sure it will," I told him.

While he was playing astronaut in the escape pod I ducked out to my office and made two phone calls. I invited Jill to an early dinner at the Eclipse. She accepted right away, asking only why I wanted to eat at five o'clock.

"I'll be baby-sitting later," I said.

Her face on my display screen looked positively shocked. "Baby-sitting? You?"

"There are more things in Heaven and Earth, Horatio, than are dreamed of in your philosophy." That was all I could think of to say. And at that, it was probably too much.

Then I tracked down Melinda by phone and invited her and Larry to have dinner, on me, in the Eclipse at eight o'clock.

She was back in the damned exercise room, walking on one of the treadmills. "Dinner?" she puffed. "I'd love to, Sam, but by eight T.J.'s usually in bed for the night."

"Oh, that's all right," I said as casually as I could manage. "I'll take care of him."

"You?" Her eyes went round.

"Sure. We're old pals now. I'll baby-sit while you and Larry have a decent meal, for a change. Why should D'Argent and the old farts on his board of directors be the only ones to enjoy good food?"

"I don't know. . . ." She wavered.

"The best cooking in the Solar System," I tempted her. "My chef is *cordon bleu.*" Which was almost true. He had worked in Paris one summer. As a busboy.

"I'll have to check with Larry," she said.

"Sure. Do that."

I noticed that she turned up the speed on her treadmill. Like I said, taking apples off a blind man's fruit stand.

So I had a nice, relaxed dinner with Jill early that evening. Then I escorted her back to her minisuite in the zero *g* section. Some of the kids were still in the gym area, whizzing around and screaming at each other.

"You're not going to get much sleep until they get put away," I said to Jill.

She gave me a crooked grin as she opened the door to her suite. "I wasn't planning to sleep—not yet."

I didn't like the sly look in her eye. "Uh, I promised Larry and Melinda I'd watch their baby. . . ."

"When do you have to be there?" Jill asked, gliding through the doorway and into her zero *g* love nest.

I glided in after her, naturally, and she maneuvered around and shut the door, cutting off the noise of the kids playing outside.

I can recognize a trap when I see one, even when the bait is tempting. "Jill—uh, I've got to go. Now."

"Oh, Sam." She threw her arms around my neck and kissed me passionately. I've got to admit that while I was kissing her back a part of my brain was calculating how much time I had left before I had to show up at Larry and Melinda's door. Which was just on the opposite side of the wailing banshees in the gym.

Reluctantly I disengaged from Jill and said, "I don't have the time. Honest." My voice sounded odd, like some embarrassed acne-faced teenager's squeak.

Jill smiled glumly and said, "A promise is a promise, I suppose."

"Yeah," I answered weakly. And I didn't want to make any promises to a United States Senator that I didn't intend to keep.

So I left Jill there in her suite, looking sad and disappointed, and zipped through the gym area, heading straight for the Karshs's suite.

Larry and Melinda were waiting for me. He was wearing an actual suit, dark blue, and a tie that kept floating loose from his shirt front. Melinda had a dress full of flounces that billowed in zero *g* like a waterfall of lace. Jack Spratt and the Missus. They'd look better in the restaurant's lunar gravity.

Melinda floated me into the bedroom of their suite, where T.J. was zippered into a sleep cocoon. They had stuffed it with pillows because it was way too big for him. The kid was sound asleep with a thumb in his mouth. I've got to admit, he looked like a little angel.

"He won't wake up for at least four hours," she assured me. "We'll be back by then." Still, she gave me the whole orientation demonstration: bottle, milk, diapers, ass wipes, the whole ugly business.

I kept a smile on my face and shooed them out to their dinner. Then I went back into T.J.'s room.

"OK, kid," I whispered. "It's you and me now."

I fidgeted around their suite for more than an hour, waiting for Larry and Melinda to get through most of their meal, thinking that I might swing back to Jill's suite and—no, no; there lay madness. Finally I went into the baby's room and gently, gently picked up T.J., blankets and all, and headed for the escape pod where I had stashed Pete.

The baby stirred and half woke up when I lifted him, but I shushed and rocked him. He kind of opened one eye, looked at me, and made a little smile. Then he curled himself into my arms and went back to sleep. Like I said, we were old pals by now.

I've got to admit that I felt a slight pang of conscience when I thought about how Larry and especially Melinda would feel when they came back from dinner and found their darling baby missing. I'd be missing, too, of course, and probably at first they'd be more miffed than scared. They'd phone around, trying to find me, figuring I had their kid with me, wherever I was. But after fifteen minutes, half an hour at most, they would panic and call for the security guards.

I grinned to myself at that. While the goons were searching the station

I'd be in a spacesuit, breaking into the Rockledge lab from the outside. The one place nobody would bother looking for me because it was already so heavily guarded. Hah!

OK, so Larry and Melinda would have a rough hour or two. They'd forget it when I returned their kid to them and they saw he was none the worse for wear. And if Larry wants to call the bumpers Karsh Shields he owes me some kind of payment, doesn't he?

Pete was in the escape pod waiting for me. I had told him only that he could play astronaut in the pod for a couple of hours, as long as he watched the baby. I had some work to do but I'd be back when I was finished. The kid was as happy as an accordion player in a Wisconsin polka bar. Little T.J. was snoozing away, the picture of infant innocence.

"I'll take good care of him, Mr. Gunn," Pete assured me. He had come a long way from the surliness he had shown earlier. He was even grinning at the thought of playing inside the pod for hours.

I'm not a complete idiot, though. I carefully disconnected the pod's controls. Pete could bang on the keyboard and yank at the T-yokes on the control panel till his arms went numb; nothing would happen—except in his imagination. I disconnected the communications link, too, so he wouldn't be able to hear the commotion that was due to come up. Wouldn't be able to call to anybody, either.

"OK, captain," I said to Pete. "You're in charge until I return."

"Aye, aye, sir!" And he snapped me a lopsided salute. The grin on his face told me that he knew what we were doing was not strictly kosher, and he loved it.

I carefully sealed the pod's hatch, then closed the connecting airlock hatch and sealed it. I hustled down the corridor to the emergency airlock and my personal spacesuit, which I had stashed there. It was going to be a race to get into a suit and out the airlock before any of the security types poked their noses in this section of the corridor. I had disabled the surveillance cameras earlier in the afternoon and duly reported the system malfunction in the station's log. By the time they got them fixed I'd be long gone.

As if on cue, the intercom loudspeakers in the corridor started blaring, "SAM GUNN, PLEASE REPORT TO SECURITY AT ONCE. SAM GUNN, PLEASE REPORT TO SECURITY AT ONCE."

They had found T.J. was missing and had called security. The panic was on.

You know, the more you hurry the slower things seem to go. Felt like an hour before I had the suit sealed up, the helmet screwed on, and was opening the emergency airlock.

But once I popped outside, I got that rush I always get when I'm back in space, on my own. My suit was old and smelled kind of ripe, but it felt homey inside it. And there was the big curving ball of Earth, huge and blue and sparkling in the sunlight. I just hung there for a minute or so and watched the sunset. It happens fast from orbit, but the array of colors are dazzling.

Now we were in shadow, on the night side. All the better to sneak around in. The controls to my maneuvering pack were on the equipment belt of my suit. I worked them as easily and unconsciously as a pianist playing scales and jetted over to the laboratory airlock on the innermost wheel.

I kept my suit radio tuned to the station's intercom frequency. Plenty of jabbering going on. They were looking for me and T.J. Starting a compartment-to-compartment search. There would be plenty more disgruntled customers before this night was through, but most of them were Rockledge people staying at my hotel at a ruinous discount, so what the hell did I care?

I got to the lab's emergency airlock with no trouble. The light was dim, and I didn't want to use my helmet lamp. No sense advertising that I was out here. Over my shoulder the lights of nightside cities and highways twinkled and glittered like a connect-the-dots map of North America.

I was just starting to work the airlock's control panel when the station shuddered. At first I thought I had hiccupped or something, but almost immediately I realized that the airlock hatch had shaken, shivered. Which meant that the whole damned station must have vibrated, quivered for some reason.

Which meant trouble. The station was big, massive. It wouldn't rattle unless it had been hit by something dangerous, or somebody had set off an explosion inside it, or—

I spun around and my eyes damn near popped out of my head. An escape pod had just fired off! Somebody had set off the explosive separation bolts and detached it from the station. It was floating away like a slow-motion cannonball.

And I knew exactly which pod it was. Pete must have figured out how to override my disconnect and booted up the pod's mother-loving systems. Now he was riding off into the sunrise, on an orbit of his own, with T.J. aboard. Son of a motherless she-dog!

I jetted after the goddamned pod. I didn't stop to think about it, I just went out after it. Everything else dropped out of my mind. All I could think of was that little T.J. and Pete were in there and they stood a better than even chance of getting themselves killed if somebody didn't get to them before they sailed out beyond reach. And it was all my fault.

If I had been really smart, I would have just reported the loose pod over my suit radio and gone about my business of burglarizing the Rockledge lab. The security people would have fired up another pod to go out and rescue the kids, everybody in the station would be plastered to the view ports or display screens to watch the scene, and I could pilfer away inside the lab without being disturbed.

But I'm not that smart. I went chasing after the damned pod. It was only after I had been barreling toward it for a few minutes that I realized I had damned well better reach it because I didn't have enough juice in my jet pack to get me back to the station again.

Pete must be scared purple, I thought, floating off into his own orbit. He apparently hadn't figured out how to reconnect the radio, because I heard nothing from the pod when I tapped into its assigned frequency. Maybe he's yelling himself hoarse into the microphone, but he's getting no response. Poor kid must be crapping his pants by now.

Fortunately, he hadn't lit off the pod's main thruster. That would've zoomed him out so far and so fast that I wouldn't have a prayer of reaching him. He had just fired the explosive disconnect bolts, which blew the pod away from the station. If he fired the main thruster without knowing how to use the pod's maneuvering jets, he'd either blast the damned cannonball down into the atmosphere so steeply that he'd burn up like a meteor, or he'd rocket himself out into a huge looping orbit that would take days or even weeks to complete.

As it was, he was drifting in an independent orbit, getting farther from the station every second. And I was jamming along after him, hard as I could.

I knew I had to save enough of my fuel to slow myself down sufficiently to latch onto the pod. Otherwise I'd go sailing out past them like some idiotic jerk and spend the rest of my numbered hours establishing my own personal orbit in empty space. I wondered if anybody would bother to come out and pick up my body, once they knew what had happened to me.

OK, I was on course. The pod was growing bigger, fast, looming in front of me. I turned myself around and gave a long squirt of my maneuvering jet to slow me down. Spun around again and saw the pod coming up to smack me square in the visor. I was still coming on too fast! Christ, was my flying rusty.

I had to jink over sideways a bit, or splatter myself against the pod. As the jets slid me over, I yanked out the tether from my equipment belt and whipped it against the curving hull of the pod as I zoomed by. Its magnetized head slid along the hull until it caught on a handhold. The tether stretched a bit, like a bungee cord, and then held.

As I pulled myself hand over hand to the pod, I glanced back at the station. It was so far away now it looked like a kid's toy hanging against the stars.

Grunting, puffing, totally out of shape for this kind of exercise, I finally got to the pod's airlock and lifted open its outer hatch. I was pouring sweat from every square inch of my skin. Got the hatch shut again, activated the pump, and as soon as the telltale light turned green I popped the inner hatch with one hand and slid my visor up with the other.

There sat Pete at the controls, ecstatic as a Hungarian picking pockets. And little T.J. was snoozing happily in the arms of Senator Jill Meyers.

"Hello, Sam," she said sweetly to me. "What kept you?"

It was then that I realized I had been nothing but the tool of a superior brain.

Jill had reconnected the pod's systems and blown the explosive bolts.

She had known exactly what I was doing because she had stuck a microminiaturized video homing beacon on the back of my shirt when she had clutched me so passionately there in the doorway of her suite.

"It's standard equipment for a U.S. Senator," she quipped, once she had plucked it off my shirt.

For once in my life I was absolutely speechless.

"When you told me you were babysitting—*voluntarily*—I started to smell a rodent," Jill said as she almost absently showed Pete how to maneuver the pod back to the station. "I knew you were up to something," she said to me.

I just hung there in midair, all my hopes and plans in a shambles.

"I've got to be invisible now," Jill said as we neared the station. She glided over to the equipment locker built into the pod's curving bulkhead and slid its hatch open. "It'll be a snug fit," she said, eyeing it closely. "Glad I didn't have dessert tonight."

"Wait a minute!" I burst. "What's going on? How did you—I mean, why—what's going on?" I felt like a chimpanzee thrown into a chess tournament.

As she squeezed herself into the equipment locker, Jill said, "It's simple, Sam. You were walking with the baby when Pete here accidentally set off the pod."

Pete turned in his pilot's chair and grinned at me.

"And then you got into your suit, with little T.J., and rescued Pierre D'Argent's only son. You're going to be a hero."

"Pete is D'Argent's son?" I must have hit high C.

"In return for your bravery in this thrilling rescue, D'Argent will let you have the space-sickness cure. So everything works out fine."

Like I said, I was just the tool of a superior brain.

"Now," said Jill, "you'd better help Pete to make rendezvous with the station and reberth this pod." And with that she blew me a kiss, then slid the hatch of the equipment locker shut.

It didn't work out exactly as Jill had it figured. I mean, D'Argent was furious, at first, that I'd let his kid into one of the pods and then left him alone. But his wife was enormously grateful, and Pete played his role to a tee. He lied with a straight face to his own father and everybody else. I figured that one day, when D'Argent realized how his son had bamboozled him, he'd be truly proud of the lad. Probably send him to law school.

In the meantime, D'Argent did indeed let me have the space-sickness cure. Grudgingly. "Only for a limited period of testing," he growled. Mrs. D'Argent had prodded him into it, in return for my heroic rescue of their only son. She got a considerable amount of help from Jill—who sneaked off the pod after all the commotion had died down.

Larry and Melinda didn't know whether they should be sore at me or not. They had been scared stiff when T.J. turned up missing, and then enormously relieved when I handed him their little bundle of joy, safe and sound, gurgling happily. I knew Larry had forgiven me when he reminded me, almost sheepishly, about changing the name of the magnetic bumpers to Karsh Shields.

So we all got what we wanted. Or part of it, at least.

The space-sickness cure helped Heaven a lot. The hotel staggered into the black, not because honeymooners took a sudden fancy to it, but because the word started to spread that it was an ideal spot for children! It still cost more than your average luxury vacation, but wealthy families started coming up to Heaven. My zero *g* sex palace eventually became a weightless nursery. And—many years later—a retirement home. But that's another story.

I licensed the *Karsh* Shields to Rockledge. A promise is a promise, and the money was good because Rockledge had the manufacturing capacity to make three times as many of the shields as I could. And, once the hotel started showing a profit, I let D'Argent buy it from me. He's the one who turned it into a nursery. I was long gone by then.

With Jill's help I raised enough capital to start a shoestring operation in lunar mining. It was touch-and-go for a while, but the boom in space manufacturing that I had prophesied actually did come about and I got filthy rich.

Of course, I more or less had to marry Jill. I owed her that, she had been so helpful. Why she wanted to marry me was a mystery to me, but she was damned determined to do it.

Of course, I was just as damned determined not to get married. So I—but that's another story. ■

We welcome your letters, which should be sent to *Analog*, 1540 Broadway, New York, NY 10036. (CompuServe: 71154,662. Internet: 71154.662@compuserve.com.) Space and time make it impossible to print or answer all letters, but please include your mailing address even if you use e-mail. If you don't want your address printed, put it only in the heading of your letter; if you do want it printed, please put your address under your signature. We reserve the right to shorten and copy-edit letters. The e-mail address is for editorial correspondence *only*—please direct all subscription inquiries to: 1-800-333-4561 or write: P. O. Box 5133, Harlan, IA 51593-5133.

Dear *Analog:*

In all humanity's history, no lovelier, more heart-moving, or more dead-on-true story of true love (and true marriage) has been written than "Capra's Keyhole." Thank you! Thank you!

ALECSANDR CAEL

Princeton, NJ

Dear Mr. Schmidt,

In regards to "Litter Control" by T. Jackson King in the April issue, it's a cute story and I have absolutely no problem with aliens running a retirement home in New Mexico, or having an alien built like a bedsheet make a hobby out of picking up litter along the highway. But to have a story state (1) that some gambler's mecca place would open soon in Silver City or (2) that Silver City is "a place of bright lights and fast money"—nope, the mind boggles at that fantasy. Suspension of disbelief is not possible.

I moved to Silver City a little over a year ago. It is a fast growing community, mainly of retirees tired of shoveling snow in Minnesota, artists from Santa Fe tired of paying the prices you have to pay in Santa Fe, and odd people like me (although I'm not *really* odd) searching for that elusive thing called "quality of life."

Recently, I went out on a date. My date had just finished a story and really wanted to celebrate big time. So we went to the only place in Silver City we knew of that offers dancing. We sat and waited and eventually one couple got up and started dancing. Eventually, a second couple also started dancing. It was obviously going to be a wild evening so we left. We went to a local bar that does have a pretty bad reputation. I sipped a Coke. My date sipped a beer. We watched the other two patrons in the bar play a pretty intense game of pool. We left. The streets were deserted, and I mean deserted. Not a derelict, not a dog, not even a piece of paper was on the street, probably because nothing was open. OK, I'm not being quite fair. This was a week night, not a weekend. On weekends, you can count on at least three couples on the dance floor and I've heard the roughest bar in town can get pretty crowded with college students really whooping it up after midterms. I'm afraid that the gambler's mecca place would have a hard time finding where to put the bright lights and fast money!

Seriously, it was fun to see names such as Silver City, Reserve, Zuni, etc. actually mentioned in a story. And I was delighted to see a reference to the 1680 Pueblo Revolt. When I moved to New Mexico and started reading up on Southwest history, I was shocked to discover how much important history happened here that is never mentioned in school textbooks in Los Angeles—such as the Pueblo Revolt. Did you know a crucially important battle of the Civil War was also fought in New Mexico?

I've always said that reading *Analog* is a good way to get an education, but I was thinking of science, not of history!

MARIAN POWELL

Silver City, NM

Dear Dr. Schmidt:

My congratulations on the April Fools' article by James P. Hogan on "Fact-Free Science" in the April 1995 issue; I haven't seen such a mixture of science and pseudo-science since the claims of "pyramid power" and "The Chariot of the Gods." It was very amusing and even convincing for a few minutes, but where was the disclaimer at the end stating it was a joke? I think one of your copy editors dropped the ball.

I confess, since my field of research doesn't have too much to do with indoor radiation, Hogan initially fooled me in that part of his article. But when he started blaming the ozone hole on volcanoes, I remembered where I'd heard that before—from the followers of Lyndon LaRouche, the Mega-Conspiracy people! And sure enough, Hogan cited R. Maduro, a known member of a LaRouche front organization, only Hogan didn't admit that "21st Century Science and Technology" was published by the LaRouchies. That was very careless of him. (By the way, the favorite volcano of the LaRouche people used to be Erebus in Antarctica instead of Pinatubo, only some meteorologists and geologists pointed out last year that Erebus's plumes don't go up 1/6th of the way to the tropopause, so it doesn't work as an explanation.) Even F. Singer, who doesn't buy the prevailing hypothesis about the ozone loss mechanism, regards the volcanic origin of atmospheric chlorine as a "red herring and completely false" (*Science 260*:1582). Hogan should have noted that, but I guess that wouldn't have worked in an April Fools' article. (However, if your readers are interested in a review of the science and the controversy around CFCs and the ozone hole, a good place to begin would be *Science*, 11 June 1993, p.1580.)

Also, since most of your readers have probably not spent much time in our lovely state of Oregon, I should note that the Oregon Institute of Science and Medicine appears to be a post office box organization. Cave Junction is *not* an important center of scientific research in this state. I do happen to know, however, that Cave Junction is a major center for the survivalists, that is to say, folks who believe that the government is plotting against the people and that there is going to be a horrible civil war soon, so you should arm yourself in preparation. I'm not claiming that Robinson is one of these people as I don't know, but the address makes me highly suspicious.

Citing Duesberg about the HIV virus is also rather dangerous in my opinion as Duesberg completely ignores that fact that roughly 80% of the current AIDS cases are caused by heterosexual transmission of the virus in Africa and southeast Asia, particularly Thailand, and have nothing to do with either drugs or homosexual behavior, the primary routes here. Last I heard of Duesberg and his ideas, he was denying that the HIV virus existed in either location. Sorry, but blood samples from non-drug using heterosexual Africans have HIV virus particles with the same genetic sequence as those taken from homosexuals in LA and drug users in New York. Furthermore, Duesberg ignores the cases of AIDS caused by blood transfusion, an infection route now stopped by screening blood donations for the HIV virus, and a demonstration of part of Koch's principles. I think this proves that Occam's Razor remains a valid scientific principle with respect to HIV causing AIDS. Duesberg has never provided other scientists with a testable alternative hypothesis, or any data to back his ideas up, basic requirements for scientific research (and lack of funding is not a valid excuse; there's plenty of work a researcher can do cheaply by reanalyzing other people's data), so Duesberg's ideas aren't very believeable. I'm surprised that Hogan didn't go all the way in his April Fools' joke and cite the Black Nationalists who claim that AIDS was invented by the Army Bio-warfare people in Maryland; it would have made the joke a bit broader and easier to see it for what it was.

I had a good laugh over Hogan's article, but since the April Fools' disclaimer was dropped, I figured I'd better write and provide some corrections. I agree with Hogan that there are scientific "sacred cows," but AIDS and the ozone hole are a little too dangerous to play head games with people about, even if it's just a joke. *Analog* really should avoid encouraging conspiracy believers, the world has enough serious and real problems as is without having those ideas stirring up people.

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The author replies. . . .

Dear Dr. Vogel,

Thank you for your response to my article in *Analog*. In reply to the points that you raise:

A lot of scientists also contest the ozone depletion theory, several of whom were cited in the *Omni* article that I mentioned. As a matter of fact, I happen to find some of the La Rouche organization's views a bit wacky, too. However, as the examples in the *Analog* article were intended to illustrate, facts and logic should be the basis for judging a scientific belief, not the politics of a selected subset of those who happen to share it.

If massive releases from volcanoes don't reach the stratosphere—and those from Mt. Pinatubo clearly did—how is the leakage from refrigerators and air conditioners supposed to, of a substance five times heavier than air, located indoors in non-turbulent surroundings? Every engineer I've talked to assures me that it's found in one place only: in the ground, right underneath the leak.

I think you'll find that Mt. Erebus is offered by depletion skeptics not as a source of ozone-destroying chlorine (they don't believe that ozone is being destroyed at any greater rate than in the natural cycle that has existed for millennia), but as a far more likely source of the higher-than-predicted (by questionable computer models) chlorine levels reported from the measuring station 11 kilometers downwind at McMurdo Sound (which is not in the stratosphere).

Arthur Robinson isn't the only scientist to have questioned the Kerry& McElroy paper, as subsequent correspondence to *Science* shows. Again, it's the data that he quotes that are relevant, not the mailing address that he uses. They are published, so his conclusions are open to being refuted or verified.

Regarding Peter Duesberg, I'd suggest that it's also rather dangerous to accept uncritically the depictions of an African AIDS epidemic as painted by the popular media. An illustration of the kind of way in which the numbers that we read come about might help make the point.

Being "HIV positive" means exhibiting a positive blood-serum reaction in tests for certain proteins presumed to indicate presence of the HIV antibody (although they have been shown to be produced by the human body too). In addition, it had been demonstrated that these tests also react positively with antibodies to malaria, leprosy, and other conditions widespread in tropical regions. Nevertheless, it is deemed that all positives shall be interpreted as due to HIV. Furthermore, every case of "AIDS" thus diagnosed that is not a flagrant homosexual or drug user is automatically assigned to the heterosexual category, hence leading to the presumption that it was acquired through heterosexual contact. Voila: instant epidemic.

In any case, as you point out, the things that are making Africans sick affect men and women equally, unlike whatever is making other groups of people sick in different ways in different places. Duesberg has never said to my knowledge that HIV-positivity isn't found among all these groups to some degree or other; simply that it isn't grounds for claiming that their different diseases are being caused by the same thing. I suspect that William of Occam would agree.

Far from ignoring transfusion recipients, Duesberg devotes a lot of space to them. The life expectancy for hemophiliacs, for example, more than doubled between 1972 and 1986, due primarily to new developments that enable them to take by injection the clotting factor that they lack naturally. Three-quarters of the 20,000, approximately, in the U.S. were infected by HIV before screening was adopted in the mid-eighties, and ought, on the contrary, to be dead if HIV is as harmful as we're told. The mortality rates for HIV positive and negative categories turn out to be about the same.

Koch's postulates require that (1) The pathogen suspected of causing an infectious disease be isolated in all cases of that disease; (2) It be cultivated in pure form; and (3) When injected into a population of a susceptible host, at least some individuals develop the same symptoms. I'm not sure which part of this the foregoing demonstrates.

Duesberg and others have suggested several eminently testable alternatives, but it appears that (with $7.5 billion being asked for this year alone) only proposals which take for granted that which is being questioned are likely to receive funding. Hardly healthy, unbiased science.

Yes, there are those who see conspiracy at work everywhere. And then there are others who see conspiracy theorists. I think it's a mistake to impute political motives to everything they say in either case. But such motives, present or not, don't affect the truth or otherwise of objective statements. Which is what I was trying to say.

JAMES HOGAN

Dear *Analog,*

In the article by James P. Hogan, "Fact-Free Science," concerning radiation hormesis (among other items), there appears to be a significant typo. On page 72, left-hand column, last full paragraph, last sentence:

"For comparison, the crossover where the net effect becomes harmful is around two rems per day; 50 (note, we're talking rems now, not millirems) causes chronic radiation sickness, and 100 is lethal."

This would indicate the range of positive benefit or hormesis to humans as having a range of more than 1,000, i.e. from 2 mrem/day to 2 rem/day. The 2 rem/day value appears to be quite high since this would be 730 rem/year or more than 150k the normally quoted LD50/30 (lethal dose to 50k of a population in 30 days) of 450-500 rem. More significantly, doses of 2 rem/day would not really be in the range normally considered "low level" and where hormesis would be expected. At 2 rem/day, few if any of the parties involved in the ongoing argument over the significance of "low level" radiation doses would feel there would be any potential for hormesis.

Additionaly, it's "acute" radiation syndrome, not "chronic," that has symptomatic onset in the 50-100 rem (short-term exposure) range. Also according to the literature I checked, short-term fatalities are not typical for doses of less than 200 rem. Note that with major medical intervention, fatalities would not be the rule, in the short-term, for doses of < 500 rem. However at doses > 800-1000 rem, short-term survival was nearly zero even with state-of-the-art medical care. This significantly conflicts with the values given in the quoted sentence and appears to be in error with literature that is not generally considered controversial.

If these are errors, it would strengthen the article greatly to correct them. The article is otherwise quite interesting since there is a long-standing and ongoing controversy over the impact and significance of long term, i.e. chronic, radiation exposure.

JOE P. HOLLAND, PH.D.
Nuclear Engineering/Health Physics
via the Internet

The author replies. . . .

The figures that I used for the optimum chronic dose and the zero-equivalent point (i.e. the crossover level where the hormetic effect ceases) were taken from a graph constructed from data obtained from a number of sources by the late Petr Beckmann (professor of electrical engineering at the University of Colorado) in the June, 1991 issue of his newsletter, "Access to Energy." I was surprised myself at the breadth of the range—but there it was.

As to the figures for the onset of symptoms and lethality, you are quite right that the text should read acute and not chronic, and I'll see if we can get Stan to mention the fact. My sources were actually in rads but I cited them as rems, ignoring the factor taking account of radiation and tissue type that would apply in practice to increase the number, so we do have something of a built-in error in the safer direction there. The purpose of the article was to acquaint readers with the notion that hormetic effects are being recognized rather than to provide a rigorous source on the subject, and I felt that going into detail on the various units would be more likely to confuse than to inform.

JAMES HOGAN

Dear Dr. Schmidt:

I began reading *Analog* at the age of nine. In my tiny New England suburb, I was the only kid in the third grade who read "Brass Tacks." I was constantly in trouble with the teacher for reading clandestine copies of Heinlein, Clarke and Asimov when I was supposed to be doing lessons that never seemed to challenge me.

At the same time, I became something of an environmentalist. Suffice it to say that in 1963, I was considered strange: a myopic tomboy in pink harlequin glasses running around vacant lots with a paper bag, picking up other people's trash, now and then sitting down on a tree stump to thumb through the latest copy of *Analog*.

I always wanted to thank the people who created the magazine for bringing me these wonderful monthly installments of reason and imagination. Now that the conventional standard is to trash technology in favor of environmentalism, no matter what the cost, I *really* want to thank you for your hard-headed editorials, and articles like James P. Hogan's "Fact-Free Science." I am sure that the anti-Freon, anti-radiation, HIV-is-the-sole-cause-of-AIDS people will say that you print these articles because you "don't *care* about what happens to this planet."

Yeah, right!

There is no cause so worthy that it justifies bad science or quasi-religious distortion of evidence. It is ironic that once leading science magazines, such as *Scientific American*, now seem to have less of a commitment to these principles than good old "wild-eyed science-fiction writers."

Keep up the good work!

FRAN ARNESEN ■

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Here is the Index to *Analog*'s sixty-sixth year: 1995, Volume 115. Entries are arranged alphabetically by author, with month and page. (There were two issues in December abbreviated Dec. and Mid-D.) When the author's name and/or part of the entry's title is omitted, it is the same as that of the previous entry. Collaborations are listed under all authors with cross references. Unless otherwise noted, each entry is identified as an Alternate View (AV), editorial (ed), fact article (fa), guest editorial (ge), novella (na), novelette (nt), poem (pm), Probability Zero (pz) serial (ser), special feature (sf) or short story (ss).

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> Yesterday's idea does not influence that of today. It influences a man who reacts with a new idea.
>
> —José Ortega y Gasset

UPCOMING EVENTS Anthony Lewis

12-14 January 1996

ARISIA '96 (Boston area speculative media conference) at Park Plaza Hotel & Towers, Boston MA. Guests of Honor—Emma Bull & Will Shetterly, Artist Guest of Honor—Lissanne Lake, Fan Guest of Honor—Rob Bazemore. Registration—$30 in advance, $40 at the door. Info: Arisia, Inc., 1 Kendall Square #322, Cambridge MA 02139. arisia-info@asylum.sf.ca.us

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12-14 January 1996

CHATTACON 21 (Tennessee SF conference) at Radisson Read House, Chattanooga TN. Guests—Walter Jon Williams, Charles de Lint, Keith Parkinson, Steven Brust, Charles L. Grant, Mark Poole. Registration—$22 until 30 November, $30 until 1 January, $35 thereafter. Info: 23908, Chattanooga TN 37422. (404) 587-6461. 71672.1416@compuserve.com OR mdillson@oass.enet.dec.com

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12-14 January 1996

TROPICON 14 (South Florida SF conference) at Hilton Airport, West Palm Beach FL. Guests of Honor—James P. Hogan, Mike Resnick. Registration—$18 until 7 January. Info: SFSFS, Box 70143, Ft. Lauderdale FL 33307. (305) 662-9426. backw@bcfreenet.seflin.lib.fl.us

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16 February 1996

BOSKONE 33 (New England Regional SF conference) at Sheraton Tara, Framingham MA. Guest of Honor—Lois McMaster Bujold, Official Artist—Gary Ruddell. Registration $33 until 15 January 1996, more at the door. Info: Boskone 33, c/o NESFA, Box 809, Framingham MA 01701-0203. (617) 625-2311. CompuServe: Sci-Fi Forum, Section 16. GEnie: SFRT3, Cat 22, Top 15. Internet: boskone@nesfa.org Home page http://www.panix.com/NESFA/home.html

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29 August-2 September 1996

L.A.CON III (54th World Science Fiction Convention) at Convention Center, Hilton, and Marriott Hotels, Anaheim, CA. Guest of Honor—James White; Media Guest of Honor—Roger Corman; Fan Guests of Honor—Takumi and Sachiko Shibano, Special Guest—Elsie Wollheim, TM—Connie Willis. Registration—$90 until 30 June 1996, $110 until 31 December 1995, then higher. Child-in-tow (3-12 in 1996)—$35, infants—free, Supporting—$30. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: L.A.Con III, c/o SCI-FI, Box 8442, Van Nuys, CA 91409. Lacon3-info@netcom.com

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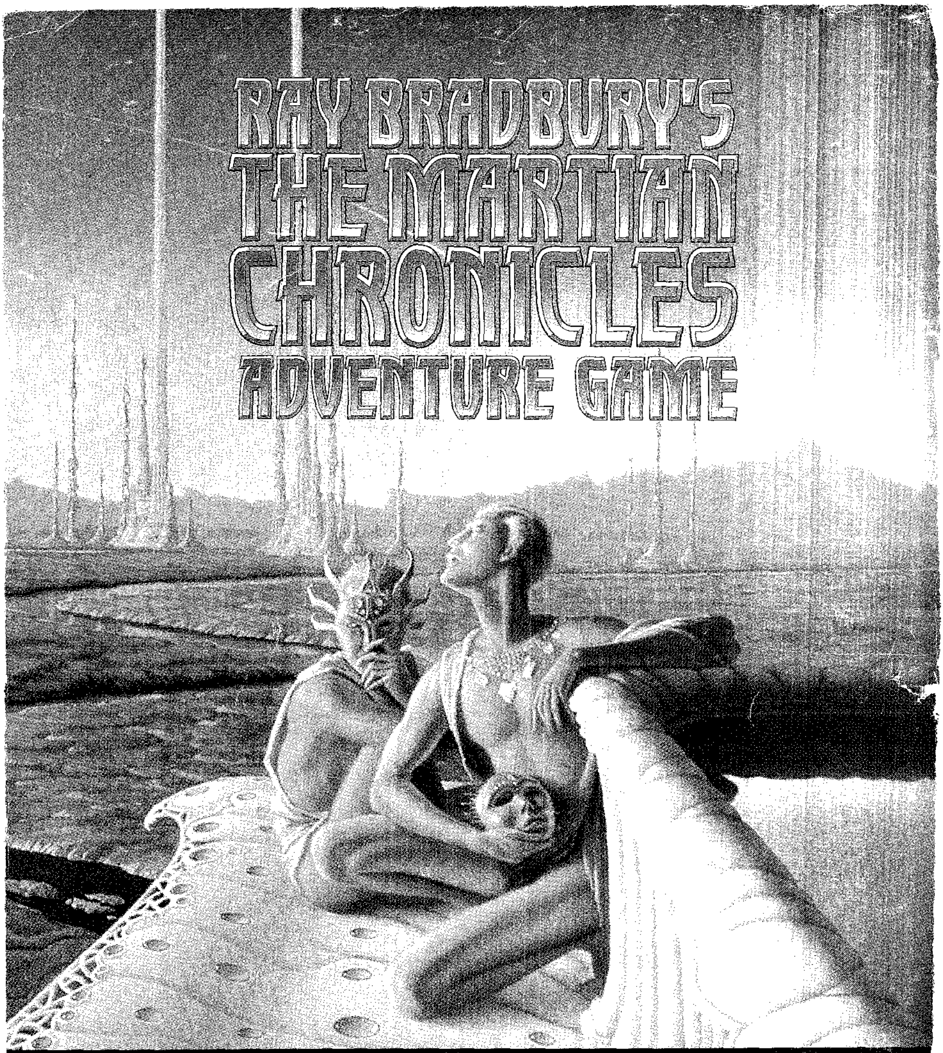

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